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" Whiskers "

It has generally been accepted that the outstanding property to be sought when manufacturing castings is that of soundness. The second consideration which we are going to suggest is the absence of " whiskers " at all stages of production. We came across this word " whiskers " when presiding over a session at the recent " Foremen's Conference." It was used with excellent effect by Mr. H. Haynes to express—we gathered—his abhorrence of the occurrence of flash, seams, joint lines and the like on the surfaces of moulds, cores and castings. After all, castings are very much like photographs, inasmuch as faults appearing in the original exposure reappear on the negative and on the finished picture. A bad photograph can be made passable by " touching-up " either the negative or the positive. So, too, a casting originating with a bad start can be made acceptable by skilful moulding and core making or by intelligent but extensive fettling. Bad equipment or poor materials create " whiskers," which under earlier and slower conditions of working than exist to-day, were eliminated by the attention of the skilled artisans. Nowadays, there is neither the time nor, quite often and unfortunately, the skill available to eradicate the banal results consequent on the appearance of " whiskers," except, of course, in the hands of the welder and fettler.

In conversation with an officer of the Ministry of Labour and National Service, who represents that Authority on a number of foundry committees, we learnt that his views were that the major research by the industry should be directed towards the complete elimination of the dressing shop, except for the removal of runners and risers. In other words, castings should—like those made by the modern precision process—require no dressing. Such a research would involve perfect refractory materials, pattern equipment, moulding and core making and setting. Obviously this is impossible, yet concentrated thought on the various phases of castings production in relation to the reduction of fettling costs would be followed by good results. No section of activity would be more profitable than that related to coring problems.

Second in importance would be attention given to the elimination of " whiskers " from the castings, for flash not only involves extra fettling, but there are records of scrapped castings attributable to this source in quite a number of articles which have been printed in the JOURNAL. The phenomenon known as " mapping " would probably enter within Mr. Haynes' definition of " whiskers." We have known where perfectly sound castings have been provisionally condemned by inspectors because of the appearance of " mapping " on the surface. Whilst it may be of no detriment, we do regard its appearance as a " signpost " indicating that attention must be given to methods and materials, as danger is not very far distant. The frontiers on the " map " may become only too well defined by " whiskered " boundaries. When last autumn we spent a morning at the works of the Renault concern in Paris, we were impressed by the extensive tooling-up designed to give dimensional accuracy to cores—a factor which goes very far towards the elimination of " whiskers." We feel indebted to Mr. Haynes for furnishing the industry with a picturesque word relating to a whole range of occurrences, which, though not necessarily productive of wasters, cause unnecessary work for either the moulder or the fettler.

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Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

ART FOUNDRY PRACTICE

To the Editor of THE FOUNDRY TRADE JOURNAL

SIR,—I found Mr. A. R. Wizard's "Art Foundry Practice" very interesting indeed.

As I am the person who actually moulded 90 per cent. of the Roosevelt statue and supervised the subsequent casting, I should like to draw your attention to one or two important inaccuracies which might tend to mislead your readers.

First, when backing the sand layer with plaster of Paris, the iron frame is used not merely to strengthen the plaster, but is actually the moulding box, and the nails mentioned are left protruding out of the sand layer in order to key the plaster backing thereon, and make the whole homogeneous.

Regarding the number of blocks mentioned for moulding horse statues, one large block on each side is not sufficient, an additional front and rear block is necessary (the front portion only being called the "portee").

It is stated that wedge runners are placed in position after covering the top of the mould with a 2-in. layer of sand. In actual fact, wedge runners are placed in position before covering the top of the model (which is presumably meant by mould), with a 2-in. layer of sand, and this is thereafter rammed on to the model and not the mould.

Where mention is made of the heads of nails being sunk below surface of mould, and carefully covered. better foundry practice would be to cut off heads of nails, as otherwise, marks from the nail-heads are likely to appear on the face of the casting.

Although Fig. 6 is a correct illustration of the completed tallow core, the method mentioned in the text has been confused. Spikes are driven into the mould before tallow is placed in, and not afterwards, as mentioned, otherwise no visible check for cracking, etc., would be available.

When replying to the question of "drying procedure," Mr. Wizard was quite wrong in stating that no drying took place before assembly. Frequently, a mould is skin-dried with a blow-pipe to permit the making of cores.

With reference to the statement that only 50 per cent. or less of wax was recoverable in the "*Cire Perdue*" process, this is indeed misleading. Very often as much as 90 per cent. is reclaimed, and the average should never be less than 75 per cent. in the French process.—Yours, etc.,

R. W. HODGES,
Director.

R.C.H. Foundry, Limited,
275, Shakespeare Road,
Herne Hill, London, S.E.24.
May 9, 1949.

THE INDUSTRIAL FINISHES EXHIBITION, which was to have been held in the Autumn of this year, has been postponed until 1950.

A.F.S., Awards

The following awards of the American Foundrymen's Society are announced. *The Peter L. Simpson Gold Medal* to Mr. Russell J. Anderson, for outstanding service to the Society and in the public interest as Chairman of the Wisconsin Chapter and of the Wisconsin Centennial Foundry Committee.

The John H. Whiting Gold Medal to Mr. S. C. Massari for outstanding contributions in the field of ferrous metallurgy, moulding and foundry practice and service to the wartime foundry industry with the Chicago Ordnance District.

The Wm. H. McFadden Gold Medal to Mr. Gosta Vennerholm for outstanding contributions to the casting industry in the field of ferrous metallurgy and practice.

In addition to the Gold Medals, awards of *Honorary Life Memberships* have been made to Mr. Anthony Haswell for outstanding and inspiring service to the industry as President of the Foundry Educational Foundation; Dean Clement J. Freund, for sincere and constant service on behalf of the castings industry by encouraging young men to enter the foundry trade; Mr. Ralph L. Lee, for steadfast and continuous service to the Society and castings industry in the field of better foundry costs; and Mr. W. B. Wallis, upon completion of his term as President of the American Foundrymen's Society.

The Foundry Exhibition Train

The Allied Ironfounders' exhibition train which has been touring the country since last October reached its journey's end at Norwich at the end of April. It has travelled 2,000 miles and visited twenty-five principal cities throughout the United Kingdom, demonstrating to public authorities, local architects and merchants a glittering array of the latest heating and cooking appliances. An instructional display of this nature makes its own contribution to national recovery by demonstrating the extent to which fuel—so tragically wasted by the old methods of domestic heating—may be richly conserved by the new. The train will be available for inspection at Kensington (Olympia) Station during the rest of May to seriously interested people.

Forthcoming Events

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

MAY 25.
Institute of Metals.
Annual May Lecture, this year to be delivered by Sir Edward Appleton, at Kensington Gate, London, S.W.7, at 6 p.m.
North-Western Fuel Luncheon Club.
"Gas Turbines," by Dr. D. M. Smith. Assembly at 12 noon for 12.45 luncheon at the Engineers' Club, 17, Albert Square, Manchester, 2.

MAY 26.
National Physical Laboratory.
"Open Day," at Teddington, Middlesex.

MAY 30 to JUNE 7.
Iron and Steel Institute.
Special Summer Visit to Norway, abridged programme printed in the JOURNAL, January 27, 1949, page 79.

Loam Moulding of an Evaporator-body Casting*

Tackle and Method for a large and complicated Casting

By W. H. Hornby

(*Continued from page* 438.)

Work now commenced on finishing the bottom half of the mould. (Fig. 16). The remaining part of the skeleton was unscrewed and removed piecemeal. All the loose bosses, ribs, etc., were withdrawn, as damping-off and patching progressed from top to bottom. The short wooden-lags were then withdrawn and the lightening core was lifted out, carrying with it the thickness loam, and other débris that had accumulated during patching. It was lowered on to a plate and cleaned off. After withdrawing the wooden segmental base flange and ingates and finishing off the bottom print, the mould was lifted out of the pit and lowered on to the stove. Again, one week's drying time was allowed. This period was used to make the top plate, grids to carry the loam, a runner box, and all the small cores from their own coreboxes. As each piece came off the stove, it was "rubbed" down, drying cracks were well scratched out and patched, and a good coat of blacking was applied.

Closing the Mould

After removing the bottom piece of the mould from the stove, it was seated in the pit. The metal surfaces were "rubbed" down, drying cracks were in this case also well scratched out and patched by rubbing soft loam into them with the fingers, and finally they were given a good coating of blacking.

Coil-support cores, regulator cores and all other small boss cores, were located in their respective prints. Care was taken to seal and lead off the vents, which were bolted and, where necessary, studded into their correct position. A ¼-in. clearance was given to cores which should have cut through to the main body core, to enable the main body core to pass them without fear of a crush. The lightening-base core was next lowered into position, sludge and emptying-connection cores were next located and studded into position, and again care was exercised in sealing off the vents. The lightening-core was secured by bolting it down to two small staples cast in the bottom plate. Two mild-steel studs were placed on the packing in the lightening core, and the bottom piece of the main core was lowered into position. The drawback and branch core for the steam inlet were next positioned, followed by the top piece of the core. A moulder, inside the core and standing on the lifting plate, matched the marks on the joint. The joint was then given a seal of loam and two semi-circular bands of steel, about ¼-in. thick by 3-in. deep, were wedged into position over the joint to make doubly sure there would be no leakage of metal through the joint. The top piece of mould (Fig. 17) was lowered over the whole core assembly and located by the marks in the loam at the joint.

Details of Plate

The next operation was the preparation of the top plate. This plate was 11 ft. 6 in. by 10 ft. and 3½-in. thick, carrying two cored lifting and bolting lugs 1 ft. square on each side. A 4 ft. 3 in. diameter hole was cast in, off-centre to match the job. Additionally there were cored holes to accommodate the two main downgates, the four top runners and the two risers. A number of holes were also cast in, so that the staples cast in the surface grids would pass through. The two surface grids were made to accommodate all the holes in the plate itself, and a number of anchoring staples were also cast in the grids.

Preparation

Packing pieces ¾ in. thick were placed at intervals on the plate, and a scattering of straw for venting purposes was laid on it. The grids were next placed on the packing pieces with the staples passing through the holes in the plate. Short lengths of ¾ in. dia. steel bars were passed through the loops of the staples on the underside of the plate and secured by

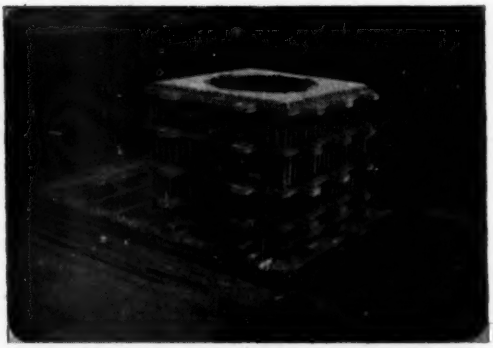

FIG. 16.—BOTTOM HALF OF THE MOULD NEAR THE STOVE PRIOR TO DRYING.

*A Paper read before the Bristol and West of England Branch of the Institute of British Foundrymen.

Loam Moulding of an Evaporator Body

driving a wedge under one end of the bar. The plate was then loamed up, and small sections of broken bricks were bedded in the spaces between the bars of the grids. Two straight edges were made parallel, and a third straight edge was then used for strickling-off the top surface. A strip of timber was wedged across the centre hole and the wall thickness of the metal in the mould was struck off by trammels. This enabled the top runners to be correctly located in the wall thickness without any fear of scoring the walls either of the core or the mould during pouring.

Runner Box Details

The runner box was shaped to accommodate the two main downgates supplying metal to the bottom flange and, also, the four top runners. The base-plate of the box was 2 in. thick, and carried six cored holes large enough to permit ramming around the wooden runner "pegs." Retaining prods about 10 in. long were spaced at about 5 in. intervals around the outside edge. Four lifting staples were cast in.

Preparation of the box was carried out in the usual manner; the inside of the plate was well clay-washed, a venting layer of straw was scattered on it, and a layer of loam was roughly laid on the bottom. The walls were built, using bricks on their 3 in. face. The inside of the box was loam covered roughly to shape, allowed to stiffen overnight and finished the following morning. The main inside dimensions of the box were:—Actual pouring basin, 20 in. by 15 in.; a 2½-in. high loam weir was used to minimise splashing; across the box at the main down-gates was 30 in., and from the weir to the opposite wall 21 in. The "legs" were 9 in. across and about 36 in. to the centre of the box, and the inside depth of the box was about 9 in. A drain plug was rammed up with sand level with the bottom of inside of box, this being to drain the over metal into a pig immediately the mould had been filled. The actual

FIG. 17.—LOWERING THE MOULD COPE OVER THE CORE.

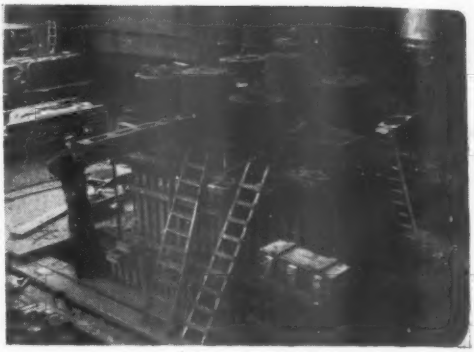

FIG. 18.—MOULD CLOSED AND WEIGHTED READY FOR CASTING.

preparation of top plate and runner box was accomplished during the mould drying time. The correct location of the top plate was effected by carefully aligning the runners over the wall thickness. The runner box was laid on a layer of riddled sand on the top plate and firmly bedded down; good facing sand was next rammed carefully around the wooden "runner pegs" to the level of the loam bottom of the runner box, the facing sand was next sleeked off and the pegs were withdrawn. Two risers were brought off from the head of the casting and the riser boxes were made up in the usual manner.

Weighting and Bolting Down of the Mould

Three 6-in.-deep packing pieces were placed inside the core cavity on the lifting plate, ashes were passed down the centre of the core and rammed level with the top of these pieces. A circular 3-ton weight was then lowered on to the packing pieces and located centrally in the cavity in the core. A further supply of ashes was passed down the core cavity and rammed between the space left around the weight and the inside core wall to a height level with the top of the weight.

Eight 1½-in. dia. bolts were used to bolt the top plate to the bottom plate at the lugs nearest to each corner. Two 12 in. by 7 in. steel girders were placed about 15 in. from the edge of the plate, one along each of the 11 ft. 6 in. sides. The heavy cast-iron girder, which had been used to anchor the spindle (its weight was approximately 3 tons) was placed centrally across the steel girders and bolted to the lugs in the centre of the 11 ft. 6 in. sides of the bottom plate, two 1½-in. dia. bolts being used. Four 3-ton weights were placed near the corners of the top plate and two 2-ton weights were placed on the cast-iron girder (Fig. 18). In theory the ten 1½-in. dia. bolts would hold the job, the weights were merely to assist in taking any possible "spring" in the top plate.

Details of the Runners

The two main downgates of 2 in. dia. were broken at the top joint and again at the bottom joint; the reason for this being twofold; first to bring the runners nearer together and use a conveniently-sized runner box, and secondly, to reduce the final fall of metal to 7 ft. 6 in. from the joint to the base flange. Four top runners, 4 in. by $\frac{1}{2}$ in., were spaced and located to fall directly into the wall of metal, all six runners were covered by well-coated loam plugs. The completed mould was then ready for pouring.

Metal Composition and Pouring

The estimated weight of the casting was 8 tons 15 cwts., and it was decided to take 11 tons of metal to pour. The metal was melted in a 6-ton per hour cupola and tapped into a 15-ton ladle. The tapping temperature, by optical pyrometer, averaged 1,370 deg. C.; actual pouring temperature was not taken, but was estimated to be about 1,280 to 1,300 deg. C.

Metal composition.—TC, 3.3; Si, 1.8; Mn, 0.9; S, 0.12; and P, 0.3 per cent.

Pouring

After the runner box had been carefully filled, the two plugs over the main downgates were lifted simultaneously; 25 secs. later the two extreme plugs were lifted, and the two remaining plugs 32 secs. later. The mould was completely filled during a further 43 secs. and pouring was immediately stopped.

FIG. 19.—FINISHED CASTING BEING DESPATCHED TO THE FETTLING SHOP.

Details of Loam Sand

The base sand for all such moulds, whether of dry sand or loam, is Mansfield red. The loam consisted of 1,000 lb. of a 50 per cent. mixture of returned loam and dry sand from mould knock-out, 600 lb. of Mansfield red and 14 shovels of horse manure. This was mixed in a pug mill for about 20 minutes.

Method of Easing the Mould and Core

About 20 minutes after pouring, the top weights were removed, and the runner-box was lifted off. The two bolts holding the cast-iron girder were eased and a few minutes later were stripped and the girder removed. All other tackle on the top plate was next removed. The remaining eight bolts were eased off gradually and finally stripped and the top plate itself was next lifted off. The bared head of the casting was then covered with a layer of floor sand to a depth of about 3 in. The 3-ton weight in the centre of the core was then lifted out. Easing of the core commenced by breaking the three grids in the top piece of core immediately above the easing bar. The grid loops behind the easing bar were next cracked off and the bar was lifted out by the crane. Whilst this work was being done, the building bars between the second and third binders, and third and fourth binders had been removed, and the brickwork had been knocked out, exposing the back of the inspection-door core. All the brickwork under the top grid was knocked out, the loam bricks which had been built-in made this job much easier. The grids were loosened by levering with a bar against the top binder, the fish plates holding the split grid were given a good rapping and the bolts were eased.

The 9 in. of loam carried on this grid was sufficiently heavy to spring the grids slightly and at the same time to protect the plate of metal from cold draughts. Similarly, the other two panels of brickwork were removed, and the two centre grids were "sprung" sufficiently to break them. The ashes that had been rammed-up in the centre of the core were raked out and all the staples were cleared of obstruction. Corrugated sheet-iron was used to cover the top and the open portions between the binders. The job was given ample time to cool. The mould had to be stripped down to the first binder in order safely to remove the casting for fettling (Fig. 19). The actual fettled weight was 8 tons 12 cwts.

Acknowledgments

To conclude, the Author wishes to express his gratitude to the management of Worthington-Simpson for permission to publish this Paper, and his sincere thanks to colleagues and staff for help so generously given in preparing data and illustrations.

SATURDAY, MAY 21, is the latest date for receiving, at Manchester, registrations for the Annual Conference of the Institute of British Foundrymen which is to be held at Cheltenham Spa, June 14 to 17.

New Foundry Amenities at Falkirk

(By our Scottish Representative)

Grahamston Iron Company, Limited, Falkirk, which was founded in 1868, have recently improved their workshop premises and added further amenities in the form of modern washrooms and canteen facilities to provide more pleasant conditions for their foundry and enamelling-shop workers. This new development, which has been carried out in accordance with recent recommendations for factory improvements, was officially opened on May 12.

Modern ideas have been incorporated in the new range of buildings which have been erected at the entrance to the firm's iron works in Gowan Avenue. The buildings include, on the ground floor, changing rooms, drying rooms, bath-house, and a well-equipped ambulance room; and on the first floor is a spacious and airy canteen and a dining hall, with modern kitchen accommodation.

Two attendants will be in charge of the washroom accommodation. In future, employees will be able to travel to work in clean clothes and change into working clothes in comfortable surroundings before they go into the foundry. After the day's work, they will again proceed to the washroom, where their soiled clothes can be removed and handed over to the attendants for careful storage overnight in the heated drying room, which will ensure that the garments will be perfectly dry for use next day. Before changing, the men will be provided with opportunities for bathing in the adjacent shower-room. The ten showers installed are of the most modern design, flow of water being individually operated by a foot lever on the floor of each cubicle. Showers are also fitted with a thermostatically-controlled water mixer, by means of which the men will be able to select the temperature of water which suits them best. A foot-bath is also provided for the use of those who wish to give special attention to their feet.

Canteen Arrangements

The canteen is situated immediately above the baths. The dining-hall, painted in bright cream colour, is lit by wide windows and with fluorescent lighting. It has accommodation for 150; service will be on the cafeteria principle. Men will be able to obtain a four-course lunch at a cost of 1s. 6d., but individual courses may be ordered if desired.

Special features of the commodious kitchen are the latest types of cooking appliances, vegetable-cleaning machines, and electrically-operated machines for mixing dough and other materials, and the fume-extraction shaft above the cooking units is designed to ensure that the kitchen will be kept cool and that cooking odours will not penetrate to the adjacent dining-hall. An ample supply of hot water for the kitchen and the spray baths is provided for by the installation in the basement of an oil-burning boiler which is fully automatic and thermostatically controlled. A view of the kitchen is shown in Fig. 1.

The development is completed by an ambulance-room block, providing full facilities for first-aid treatment. The rooms are of easy access, and are completely furnished with modern equipment for the rapid treatment of injuries and minor illnesses.

Opening Ceremony

Mr. Walter W. Mitchell, chairman and managing director, presided at the opening ceremony in the canteen, and was supported by his sister, Miss J. Mitchell, and his brother, Mr. W. T. Mitchell, director and secretary, while the guests included Provost Peter Symon, of Falkirk; Provost J. A. Penny, of Grangemouth; Mr. George M'Laren, C.B.E., convener of Stirling County Council; Mrs. James Mitchell, Miss Brand, H.M. Inspector of Factories, Stirling; Mr. F. F. M'Fadzean, secretary of the National Light Castings Industries Federation, Glasgow; Mr. R. H. Ward, Mr. W. Burt, and Mr. W. Ure, representing the Amalgamated Union of Foundry Workers; Mr. Arthur Fair, General Iron Fitters' Association; Mr. H. Wilson, architect, Falkirk; and Mr. A. J. Smith, Stirling County Architect.

Mr. Mitchell, welcoming the company, explained that the erection and equipping of the buildings had been a somewhat protracted job owing to the difficulty in the first instance of obtaining the necessary licences and, later, to delays in getting delivery of materials, plant, etc. However, the various amenities were now

(*Continued on page* 474)

FIG. 1.—KITCHEN IN THE NEW CANTEEN AT GRAHAMSTON IRON COMPANY, LIMITED.

Estimation of Coal Dust in Foundry Sand

Suggested Methods resulting from Exhaustive Researches

By A. McD. McConnell, A.R.I.C. and J. McPheat†*

The control of foundry sand is affected largely by making certain mechanical tests, and from the results of these, making the necessary corrections. If, in any foundry, sufficient experience be available to indicate the desirable range of green or dry strength, and green or dry permeability, the regular carrying out of the tests and the probable deductions from the results, should provide a considerable amount of control. One of the variables, *viz.*, water content, can be readily determined by means of the "Speedy" moisture tester.

Coal dust is an important addition to most foundry sands and it is, therefore, very desirable to have a dependable method for its estimation in a given sand. There is especially need for this information to be applied to circulating-sand systems in which the sand is in very constant use. In such cases it is necessary to make frequent additions of coal dust in order to compensate for the amount lost or rendered ineffective by contact with the molten metal. Most moulding-sand mixtures contain a considerable quantity of sand which has been used before, resulting in a sand mixture which has lost a portion of its coal-dust addition through burning. Only a limited amount of the coal dust present in the mould is subject to the effect of heat, that is, in the layer of sand within a short distance of the molten metal. Consequently, all sand mixtures in which it is desirable to estimate the coal dust, will contain unaffected coal dust plus coke formed by heating by the molten metal in the absence of air, and also there will be present a series of intermediate products of the decomposition of the original coal dust.

Probably the most important function of coal dust is the evolution of coal gas and products of distillation of the coal particles at, or near, the face of the mould subjected to the high temperature of the molten metal. Furthermore, there is some evidence to suggest that deposited carbon and coke, formed by the action of heat on a previous addition of coal dust, has a beneficial effect on the production of a smooth skin on the resultant casting. From the point of view of "useful coal dust" there is no evidence to show that mineral ash present after burning out of the coal dust, serves any useful purpose. Most foundrymen are agreed that the useful action of coal dust is attributable to the volatile matter or the volatile matter and fixed carbon.

Various grades of coal dust are available to the foundry; these are made from bituminous coals. It has been suggested that coal dust for the foundry industry should have the following characteristics:—Mineral ash, 10 per cent. maximum, and volatile matter not less than 30 per cent. However, it is not unusual at the present time to find a supply of coal dust with an ash content of 20 per cent. or even higher. In any attempt to measure the quantity of coal dust present in a sample of sand, the ash content must be left out of the picture. Consequently, future reference to coal dust will be to ash-free coal dust, *i.e.*, coal dust when calculated to the ash-free state.

A number of methods of estimating the approximate amount of coal dust present in a moulding sand have been suggested, and there appear to be a few foundries who are using empirical methods devised in an attempt to control the amount of coal dust required to give the desired properties. The most important of these methods are by (*a*) estimating the loss on ignition, (*b*) estimating the total carbon present, and (*c*) estimating the volatile matter. In a critical examination of these three methods, it will be found that all are liable to gross error, particularly is this so when applied to moulding-sand mixtures in circulating systems in which the sand is in very constant use. Most moulding sand contains calcium carbonate. It is not unusual to find as much as 2½ per cent. in a new delivery of sand, and further carbonate may be introduced *via* some of the bonding agents. Apart from this possible source of error, most moulding mixtures also contain a quantity of organic matter, such as cereal products. These may be added by the founder to improve the working properties or may find their way into the sand from knock-out material from cores. Examples of this class are starch and dextrin.

Discussion of Previously Suggested Methods

1. *Total loss on ignition*:—This method consists of igniting a quantity of the sample and taking the loss in weight as a measure of the coal dust present. With most types of moulding sand this method could give erroneous results, as the loss on ignition would include all combined water from the clay fraction, all carbonates present in the original sand, and all organic matter such as cereal binders. In addition to these sources of error, the loss would include fixed carbon from the coke present, which, depending upon the amount of burning that has taken place in previous use of the sand, might be quite considerable.

2. *Determination of Total Carbon*:—The estimation of total carbon is carried out in the usual manner by combustion in oxygen. The carbon as estimated in a given sample of sand is correlated to coal dust. Whilst this method is free from any inaccuracies by inclusion

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† Senior Analyst at G. & J. Weir, Limited, Cathcart.

Estimation of Coal Dust in Foundry Sand

of combined water, the figure obtained will include carbon from carbonates, coke, coal dust and organic binders.

3. *Determination of Total Volatile Matter*:—In this method the sample is heated in a stream of purified nitrogen. The loss in weight is taken as the volatile matter present in the coal dust and is correlated to coal dust content. The loss in weight by this method will include, in addition to that from the volatile matter of the coal dust, that from all the volatiles present, such as cereal products, CO_2 from carbonates, also combined water from the clay.

To test the magnitude of errors and reproducibility of results, two sets of standard samples were prepared; the samples contained a known quantity of coal dust. These samples were prepared from the following:—

Sand (*Mansfield Red*):—
Clay = 9.2 per cent. Loss on ignition = 1.36 per cent. Carbon content = 0.27 per cent. A.F.S. Fineness = 168.

Coal Dust:
Approximate percentage analysis of dry sample:—
Volatile matter = 32.8. Volatile Carbon = 11.8. Fixed Carbon = 43.2. Total Carbon = 55.0.
Calculated to the ash-free coal-dust percentage:—
Volatile matter = 43.2. Volatile carbon = 15.5. Fixed carbon = 56.8. Total carbon = 72.35.

From this sand and coal dust, two sets of three samples were made up to contain various quantities of coal dust. They were prepared by adding the requisite quantity of coal dust to 200 gm. of dry sand. The additions were mixed thoroughly by light grinding in a Wedgewood mortar for 15 minutes. After careful preparation, the standard samples were reserved in air-tight containers and suitably marked. The following tables give a list of the standard samples prepared and the results obtained using the three methods of analysis previously outlined (Tables I to III).

First Set of Standard Samples:
Simple mixture: Containing sand plus coal dust.

Mark.	Coal dust, per cent.
A1	1.90
B1	3.62
C1	5.70

Second Set of Standard Samples:
Complex mixture: Containing sand plus 1 per cent. crushed coke plus 1 per cent. cereal binder plus 1 per cent. calcium carbonate plus coal dust.

Mark.	Coal dust, per cent.
A2	1.85
B2	3.52
C2	5.55

Examination of the results obtained show that the three methods outlined are inadequate to give measure of the coal dust present. The results do show that the errors are large when materials such as cereal binders are present. It may be argued that a correction can be applied for the interfering substances such as combined water, carbonates, binders, etc. However, in most sand systems these substances can never be taken as constant, as this will depend on the quantity lost during previous heating of the sand.

TABLE I.—*Estimation of total Loss on Ignition. Average of Six Tests on Each Sample.*

Sample mark.	Coal dust present. Per cent.	Coal dust present. Theoretical loss due to coal dust, per cent.	Spread of results, loss on ignition, per cent.	Loss on ignition, average, per cent.
Simple mixture.				
A1	1.90	1.90	3.22 to 3.28	3.26
B1	3.62	3.62	4.96 to 5.08	5.00
C1	5.70	5.70	7.00 to 7.12	7.06
Complex mixture.				
A2	1.85	1.85	5.00 to 5.30	5.22
B2	3.52	3.52	6.00 to 6.10	6.06
C2	5.55	5.55	9.10 to 9.28	9.16

A survey of the results from Tables I, II and III shows that in Table III, a slight correlation between carbon as estimated and carbon present in the sample as coal dust does exist. For example, in the simple mixture samples A1, B1 and C1, the carbon as estimated is within analytical tolerance of the calculated theoretical carbon present from the coal dust. However, in the complex mixture samples A2, B2 and C2, the carbon was found to be consistently high by approximately 1¼ per cent. The high results are explained by the presence of coke, cereal binder and calcium carbonate added to these samples.

In any attempt, therefore, to estimate the coal dust by means of the carbon content, the carbon of other carbonaceous matter such as carbonates, binders, etc.,

TABLE II.—*Estimation of Total Volatile Matter. Average of Six Tests on Each Sample.*

Sample mark.	Coal dust present. Per cent.	Coal dust present. Theoretica loss due to volatile matter, per cent.	Spread of results, volatile matter, per cent.	*Volatile matter, average per cent.
Simple mixture.				
A1	1.90	0.82	2.00 to 2.30	2.18
B1	3.62	1.56	2.90 to 3.12	2.98
C1	5.70	2.48	3.70 to 3.77	3.72
Complex mixture.				
A2	1.85	0.80	3.18 to 3.36	3.28
B2	3.52	1.52	3.40 to 3.70	3.46
C2	5.55	2.40	5.19 to 5.60	5.38

must be taken into account. If the sample, however, can be separated from these interfering substances by some pre-treatment, then an estimation of carbon will give a more truthful guide to the coal dust present.

TABLE III.—*Estimation of Total Carbon. Average of Six Tests on Each Sample.*

Sample mark.	Coal dust present. Per cent.	Coal dust present. Theoretical carbon due to coal dust, per cent.	Spread of results, total carbon, per cent.	Total carbon, average per cent.
Simple mixture.				
A1	1.90	1.37	1.34 to 1.42	1.38
B1	3.62	2.62	2.60 to 2.70	2.64
C1	5.70	4.12	4.10 to 4.18	4.15
Complex mixture.				
A2	1.85	1.34	2.52 to 2.62	2.58
B2	3.52	2.54	3.76 to 3.85	3.80
C2	5.55	4.00	5.33 to 5.49	5.44

Discussion of Proposed Method

From the point of view of "useful coal dust" it would seem desirable to estimate the volatile matter in the coal-dust portion of a sample. This is only possible in a mixture of sand and coal dust by way of the volatile carbon. Then if the assumption is made that the volatile matter of coal dust contains a constant quantity of carbon, the volatile matter can be calculated *e.g.*, three different samples of coal dust examined gave the following ratios of volatile carbon to volatile matter, 1 to 2.78:2.80:2.80. If other carbonaceous interfering substances can be removed by some pre-treatment, an accurate estimation of the volatile carbon can be relied upon. If then, under these circumstances the conversion factor of volatile-carbon to volatile-matter holds, a measure of the "useful coal dust" is obtained. Similarly, as in the process of arriving at the figure for the volatile carbon, the fixed and total carbon must be determined. After this, the volatile matter plus the fixed carbon can be taken as a measure of the total coal dust, whether useful or otherwise. There is a possibility that a term such as "coal dust equivalent" may be a better expression for this measure of total coal dust, as it will almost always include coke from partly burned coal dust.

Some experimental work has been carried out with these points in view and a method has been developed to give an accurate figure for the carbon content of the volatile matter and the fixed carbon from the coal dust in a sample of foundry sand. The method is based upon one assumption, *i.e.*, that the whole matter of coal dust contains a constant quantity of carbon. Of the three samples from different deliveries examined, the ratio did not substantially vary and this was taken as 1 : 2.8. However, where the greatest accuracy is required, this ratio can be checked in individual laboratories. A sample of the supply of coal dust can be drawn and analysed from time to time and the ratio determined and suitably corrected.

Outline of Proposed Method

The sample on receipt is dried at 105 deg. C. and any metallic particles are separated by a magnet. Two samples are weighed out and each is treated with boiling water and dilute hydrochloric acid and then dried at 105 deg. C. Total carbon is estimated in one sample by burning it in oxygen by the usual "combustion carbon" method. The second sample is ignited and cooled under nitrogen to remove all the volatile matter and the carbon is then estimated as in the first sample. This gives the fixed carbon—from the difference of these two figures the volatile carbon is obtained.

$$\text{Volatile carbon} \times \frac{\text{volatile matter in coal dust}}{\text{volatile carbon in coal dust}}$$

= volatile matter, and volatile matter + fixed carbon = coal dust (or coal-dust equivalent).

Apparatus Required.

Two off No. 1 Vitrosil sintered crucibles as used for combined carbon.

One combustion carbon furnace and train (Fig. 1).

One combustion tube furnace and train for volatile matter in coal, etc., as B.S.S. 735 Fig V (or as Fig. 2).

Fused alumina—carbon free. Type R.E.H.T. No. 90.

Hydrochloric acid, 10 per cent.

Recommended Procedure.

On the receipt of the sample, mix it thoroughly and draw a representative sample by quartering—approximately 10 gm. Dry this at 105 deg. C. for one hour. Extract all metal particles with a good strong magnet and mix the remainder thoroughly by grinding softly in a Wedgewood mortar. Prepare two vitrosil sintered crucibles for the estimation by placing ¼ in. layer of fused alumina on the surface of the sintered disc. Weigh-off accurately 0.5 grm. of the sample and mix

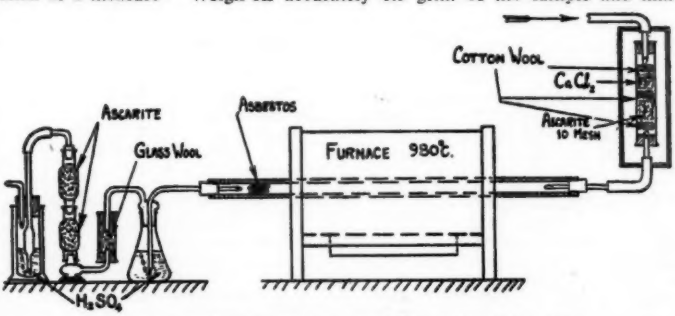

FIG. 1.—APPARATUS FOR THE DETERMINATION OF CARBON IN SANDS CONTAINING COAL DUST.

Estimation of Coal Dust

this carefully on a piece of glazed paper with 2 gm. of fused alumina. Brush the mixed sample into the vitrosil crucible on top of the ¼-in. layer of fused alumina previously added. Prepare sample No. 2 in exactly the same manner. Now place one of the crucibles containing the sample in a stopper suitably made to fit in the neck of a suction flask. Apply gentle suction (10 to 15 in. Hg) and run 25 ml. of boiling distilled water through the crucible. Next run through 25 ml. of boiling dilute hydrochloric acid (10 per cent.) and then 20 ml. of boiling distilled water, increase suction if necessary. When the last of the water is all through the crucible give a small wash with 15 ml. of alcohol. Remove the crucible and dry at 105 deg. C. for 1 hour. Treat sample No. 2 in exactly the same manner. Next, place crucible No. 1 (containing the first sample) on a combustion carbon boat with the open end facing the absorption train and place in the combustion tube of the carbon furnace, connect up the oxygen flow and estimate carbon in the usual manner—use a temperature of 1,000 deg. C. and an oxygen flow rate of 200 mls. per minute. Calculate the CO_2 to C, this gives the total carbon.

Place crucible No. 2 (containing the second sample) on a combustion boat with the open end pointing in the direction of the nitrogen flow, insert into the cold end of the tube of combustion furnace (Fig. 2) and replace the stopper. Allow the nitrogen to flow through the tube for a few minutes and draw the sample into the heated zone by means of the Nichrome wire pulled through the mercury trap. When the volatile matter is all removed (5 minutes), pull the boat and sample to the cold end of the tube and allow to cool whilst still passing nitrogen. When cold, remove the boat and sample and place them in the tube of the combustion carbon furnace, proceed as in sample No. 1 and estimate the carbon in the usual manner. Calculate to C the increase due to CO_2; this gives the fixed carbon.

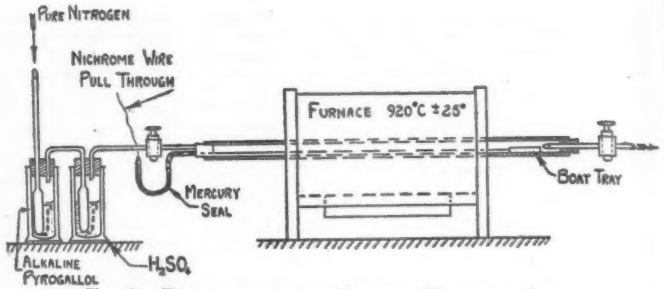

FIG. 2.—DETERMINATION OF VOLATILE MATTER IN COAL DUST CONTAINED IN MOULDING SAND.

Tests on Standard Samples Using the New Method

To test the accuracy of the method, a large number of estimations were carried out on the six standard samples (previously detailed). The results obtained are listed in Tables IV and V. Table IV gives the results obtained on the sample without pre-treatment of the sample to remove carbonates and binders, etc. Table V is a list of results using the method as outlined. Each figure used in the Table is an average of twelve determinations for total and fixed carbon. An idea of the reproducibility of the method can be obtained from the spread of results which are given on volatile matter and volatile matter plus fixed carbon.

Abbreviations used in tables:—T.C.=Total Carbon: F.C.=Fixed Carbon; V.C.=Volatile Carbon, *i.e.*, total carbon−fixed carbon, and V.M.=Volatile Matter, *i.e.*,

$$\text{V.C.} \times \frac{\text{volatile matter in coal dust}}{\text{volatile carbon in coal dust}}$$

$$\frac{\text{Volatile matter of coal dust}}{\text{Volatile carbon of coal dust}}$$ is taken as 2.8 for this work

TABLE IV.—*Results on Standard Samples Without Pre-treatment with Acid, etc.*

Sample mark.	Coal dust present.		T.C. estimated, per cent.	F.C. estimated, per cent.	V.C. = T.C. − F.C. per cent.	V.M. = V.C. × 2.8 per cent.	V.M. + F.C. per cent.	Spread of results.	
	per cent.	Theoretical V.M. per cent.						V.M. per cent.	V.M. + F.C. per cent.
Simple mixture.									
A1	1.90	0.82	1.38	1.07	0.31	0.87	1.94	0.79 to 0.98	1.86 to 2.05
B1	3.62	1.56	2.64	2.05	0.59	1.65	3.70	1.54 to 1.76	3.59 to 3.80
C1	5.70	2.46	4.15	3.24	0.91	2.55	5.79	2.44 to 2.66	5.68 to 5.90
Complex mixture.									
A2	1.85	0.80	2.58	1.88	0.70	1.96	3.84	1.50 to 2.27	3.38 to 4.15
B2	3.52	1.52	3.80	2.96	0.84	2.35	5.31	2.18 to 2.46	5.14 to 5.42
C2	5.44	2.40	5.44	4.00	1.44	4.03	8.03	3.91 to 4.20	7.91 to 8.20

From these results (Table IV) it will be seen that in the case of the simple-mixture samples A1, B1 and C1, the results for V.M. and V.M. plus F.C. are in good agreement with the calculated theoretical value expected from the coal dust. The same does not apply to the samples of the complex mixture, the V.M. and the V.M. plus F.C. results are much higher than expected. The increase in this case is due to the inclusion of the volatile matter and fixed carbon of the added constituents.

etc., is most difficult, in fact almost impossible by normal methods. However, this has been overcome by the use of a small sintered crucible and use of suction for washing. If the procedure outlined be adopted, the method can be carried out in 3 hrs., and a batch of 6 crucibles, *i.e.*, 3 estimations, can be done in under 4 hrs.

For the average foundry laboratory which is equipped for the analysis of cast iron and for sand tests, no further special apparatus is required. The fur-

TABLE V.—*Results on Standard Samples—After Pre-treatment of Samples with Acid, etc.*

Sample mark.	Coal dust present.		T.C. estimated, per cent.	F.C. estimated, per cent.	V.C. = T.C. − F.C. per cent.	V.M. = V.C. × 2.8 per cent.	V.M. + F.C. per cent.	Spread of results.	
	per cent.	Theoretical V.M. per cent.						V.M. per cent.	V.M. + F.C. per cent.
Simple mixture.									
A1	1.90	0.82	1.36	1.07	0.29	0.81	1.89	0.78 to 0.87	1.85 to 1.94
B1	3.62	1.56	2.66	2.09	0.57	1.60	3.69	1.54 to 1.62	3.63 to 3.71
C1	5.70	2.46	4.14	3.26	0.88	2.47	5.73	2.42 to 2.54	5.68 to 5.80
Complex mixture.									
A2	1.85	0.80	2.00	1.70	0.30	0.84	2.54	0.79 to 0.81	2.49 to 2.57
B2	3.52	1.52	3.29	2.73	0.56	1.57	4.30	1.57 to 1.60	4.27 to 4.33
C2	5.44	2.40	4.85	3.96	0.89	2.49	6.45	2.46 to 2.55	6.42 to 6.51

From the results on Table V, it will be noted that the pre-treatment of the sample has resulted in a closer relationhip between the theoretical and estimated V.M. The V.M. of the complex-mixture samples A2, B2 and C2 are very close to those expected and are almost identical to the corresponding samples of the simple mixture. The coke present in the complex samples does not affect the result of the V.M., but does, of course, affect the figure for F.C. and consequently the final figure represented by V.M. plus F.C.

General Conclusions

It is believed that the method described gives reliable figures for the V.C. and F.C. derived from coal dust in a sand mixture. Provided the ratio of volatile carbon to volatile matter remains constant, the volatile matter of the coal dust present can be calculated. From the point of view of the control of foundry sand, the method will supply two figures as a working basis for the coal-dust content. If desired, the volatile matter alone may be used as a measure of "useful coal dust" and maintained at a pre-determined level. On the other hand, the volatile matter plus fixed carbon may, to some, appear to be a better measure of the value of coal dust, consequently some foundry chemists may prefer to use this figure and work within a pre-determined range.

Irrespective of what method be used for assessing the value of the final results, the foundry control chemist should, in a short space of time, arrive at a maximum and minimum figure consistent with good casting properties of sand, and with them he should obtain a certain degree of control. The method described might appear, at first, to be somewhat difficult to carry out in the average foundry laboratory. The filtration, for example, of a sand containing clay, nace used for carbon by combustion, can be used with little or no alteration. However, it will be found advisable to add a further drying train of concentrated sulphuric to remove moisture when carrying out the test, otherwise the dessicants in the normal combustion carbon train will be ruined. For the removal of volatile matter, the furnace used for gas test in core sand as outlined in a previous report, is suitable without any alteration. From the point of view of apparatus and procedure, the method is well within the scope of the average foundry laboratory.

The authors are indebted to the continuous help, guidance and encouragement of Mr. J. Arnott, F.R.I.C., F.I.M., and to the Directors of G. & J. Weir, Limited, Cathcart, for permission to carry out this work.

A.B.B.F. London Area Meeting

An informal meeting of members of the Association of Bronze and Brass Founders in the London area will be held at the Clarendon Restaurant, Hammersmith, on May 26, commencing with luncheon at 1.0 p.m. The film "Bronze Founding," produced by Foundry Film Services, Limited, to encourage recruitment in the industry, will be shown and discussed. The President of the Association, Mr. Max Horton, expects to be present.

The Editor of "Pig Iron Rough Notes," the house organ of the Sloss Sheffield Steel and Iron Company, Birmingham, Alabama, is offering a prize of a $50 savings bond to the moulder sending him the first good cup, saucer and spoon casting in cast iron of the type described by Mr. James Timbrell in an article reprinted from the FOUNDRY TRADE JOURNAL dated December 23, 1948.

Notes from the Branches

Newcastle-upon-Tyne

This branch of the Institute of British Foundrymen concluded a highly satisfactory session with their Annual Meeting, held in April. The Branch President, Mr. S. Unsworth, reveiwed the activities during the session and commented upon the excellent work of the Programme Committee in providing a wide variety of subjects dealing with all branches of founding; the interest aroused and members appreciation were attested by the high average attendance at their meetings. He was particularly gratified by their close association with the Department of Metallurgy at King's College whereby the Branch and students of the Department were free to attend each others' meetings. This was mainly due to the kind co-operation and help of Professor Preece, M.Sc., F.I.M., and his assistant, Mr. C. R. Tottle, B.Met., A.I.M. Not only had Professor Preece invited the co-operation of the Branch at meetings held in King's College, but he had also opened the Department to visits by members and students throughout the Tyneside Area. In adtition, he had readily agreed to housing the projected Branch Library at the Department of Metallurgy, and Mr. C. R. Tottle had votunteered his services as librarian. Professor Preece and Mr. Tottle were accorded the thanks of the Branch for this kind co-operation.

Mr. Unsworth commented upon the increase in membership, which had risen by 37 members of all classes to a total of 203. He expressed the regret of the Branch at the resignation of Mr. Lashly from the office of Honorary Secretary, which he had filled with distinction for so many years. The Institute had already recognised the value of Mr. Lashly's services when they awarded him the Meritorious Services Medal at the Annual Meeting last year. Mr. F. Robinson had been nominated to undertake the duties of Honorary Secretary. During his probationary period as understudy to Mr. Lashly, he had shown that he has a comprehensive grasp of the duties appertaining to the office.

The election of officers for the 1949-1950 session then took place, the following being elected: As *Branch President*, Mr. H. Smith; as *Senior Vice-President*, Mr. H. Charlton; as *Junior Vice-President*, Mr. C. Lashly; and as *Hon. Secretary*, Mr. F. Robinson. The meeting concluded with the showing of the film "A.1 at Lloyds," which was much enjoyed.

A Correction

George Salter & Company, Limited, West Bromwich, draw our attention to the fact that the weighing machine they showed at Castle Bromwich and to which we made reference in our short description, costs between £119 and £215, and not £60 as we printed; this was the result no doubt of a misunderstanding of the conversation between our representative and the personnel on the stand.

Carbon Equivalent in Cast Iron

*By Gabriel Joly**

The properties of irons are quite frequently given as a function of the carbon equivalent. On recently being asked as to what exactly was meant by this expression, the writer has set down the following explanation. An examination of the iron-carbon equilibrium diagram, when neither silicon nor phosphorus is present, shows that the lowest melting point is that which corresponds to a carbon content of 4.23 per cent. At this point the "starting" solidification temperature and the "finishing" temperature of solidification become one. The point is called the eutectic point.

The presence of silicon and phosphorus in the metal modifies the carbon content of the eutectic point. Research carried out on this important question shows that when silicon is added to the metal, the carbon actually occurring in the eutectic is lowered by a third of the silicon content. It is much the same for phosphorus. Thus it can be stated that the eutectic carbon content of a cast iron is given in the formula:—

C per cent. = $\frac{1}{3}$ (Si per cent. + P per cent.).

When melting in the cupola, the carbon content of the metal melted has a tendency to be that of the carbon content of the eutectic. This, however, is not always desirable for the mechanical properties are correspondingly increased as the carbon percentage is lowered below the eutectic level. It is for this reason that one relates the properties of an iron, not to their carbon content but to what is called the carbon equivalent. The latter has for its value the carbon content of the metal increased by a third of the sum of silicon and phosphorus percentages. The difference between this value and 4.23 per cent. shows up clearly, whether the metal carries a carbon percentage less than, equal to, or greater than the eutectic carbon content. Taking, for example, the case of an iron having the following chemical composition:—

Carbon	...	...	...	3.25
Silicon	...	...	...	2.10
Phosphorus	...	...	...	0.30

The value of the carbon equivalent is:—

3.25 per cent. + $\frac{1}{3}$ (2.10 per cent. + 0.30 per cent.)
= 4.05 per cent.

The carbon equivalent is less than 4.23 per cent. and is called hypo-eutectic. It is worth noting that one should be able to work in the opposite direction by calculating the eutectic carbon of a metal having 2.10 per cent. silicon and 0.30 per cent. phosphorus, eutectic carbon = 4.23 − $\frac{1}{3}$ (2.10 per cent. + 0.30 per cent.) = 3.43 per cent. The difference between the carbon content of the iron and the eutectic carbon is equal to:—

3.43 per cent. − 3.25 per cent. = 0.18 per cent.

Similarly, the difference between 4.23 per cent. and the carbon equivalent 4.05 per cent. is equal to 0.18 per cent. It shows that the two methods yield the same conclusions, but it must be admitted that the introduction of the carbon equivalent by a very much simpler calculation gives the result.

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*Translated from *Fonderie*.

Conference on Cupola and Converter Refractories

On Thursday and Friday of last week there was held at Ashorne Hill, near Leamington Spa, a Conference on Cupola and Converter Refractories, organised by the British Iron and Steel Research Association. About eighty delegates attended, representing iron and steel founders, manufacturers of refractories and foundry plant and the various research associations. The Chairman was Dr. A. H. B. Cross, of the British Refractories Research Association.

The objects and scope of the conference were briefly referred to by Dr. W. J. Rees, O.B.E. (late of Sheffield University) in his introductory remarks, in the course of which he said that enquiry into the nature and service behaviour of refractories was especially necessary at this juncture because there was a wide divergence between test values obtained on refractories and their behaviour under conditions of actual service. Difficulty was experienced in relating empirical values to conditions where load, expansion and like stresses were operative; whereas a refractoriness test disclosed a fusion point, possibly the viscosity of the fixed mass was of major importance. It was becoming abundantly clear that there was a ternary relationship between coarse portions, clay bond, and fine constituents in a raw refractory intended for ramming. Ramming density and amount of added water and the rapidity and temperature increments of the drying process all affected practical results, and the idea behind the conference was to attempt correlation between theory and practice. Following this general introduction, the conference was arranged in three groups of subjects—converter refractories, cupola refractories and factors common to both.

Converter Refractories

The first Paper in this section was by Mr. J. L. Harrison (late of Catton & Company, Leeds, now with Low Moor Alloy Steelworks, Limited), entitled "The Performance of Various Monolithic Converter Refractories." The lecturer related the conclusions reached in the first report of the Iron and Steel Institute Committee on Side-blown Converter Practice, Section II of which dealt with laboratory tests on a series of acid converter monolithic refractories. The work had been continued by B.I.S.R.A., who had obtained the collaboration of Catton & Company, Leeds, for field trials of six of the refractories under conditions which were kept as constant as possible.* Results were quoted for four monolithic refractories, which, only generally, followed the direction of those anticipated from the laboratory tests. In particular, refractories with balanced shrinkage in firing and coefficient of expansion characteristics, together with high thermal conductivity, gave best results. The converters on which tests had been carried out were oval in cross section, some 4 ft. by 2 ft. 10 in., with bottom and tuyeres of silica brick and a 12-13 in. body lining thickness. In these, oxygen enrichment of the blast was now a normal feature of operation, but this was not so when the tests referred to were being carried out. Variations from standard in respect of blowing time and metal composition (amounts of C, Si, and Mn affect the ruling temperatures), influenced the value of the detailed results obtained.

The Paper which followed, that of Mr. P. Murray (Sheffield University), "Laboratory Investigations of Used Monolithic Converter Materials," referred to tests on the refractories after the field trials quoted by Mr. Harrison. A cross-section of the lining after use consisted physically of a very thin film of slag on the inside. Next, a black zone of fused refractory, then an intermediate layer, partially "burnt" but unfused, before the more or less unaffected outer shell. Linings with a high refractoriness value gave a thin "fused" layer, it was postulated that this was easily penetrated in depth by slags, but greater *dilution* with flux or slag was required to lower its refractoriness. On the other hand, the success of materials having, initially, lower refractoriness, was a function of the thickness of the "fused" layer and its *resistance* to slag penetration.

In the discussion which followed these Papers, Dr. White (of Sheffield University), confirmed the latter conclusions referred to above; the Chairman (Dr. A. H. B. Cross) discussed the effect of particle grading of a monolithic refractory and suggested that ultimate particle size as distinct from sieve analysis should be studied, and Mr A. L. Bradley (Refractory Brick Company of England, Limited) stressed that "permeability," and in particular permeability as determined by a "liquid absorption" method, should be used as a further test of a ramming refractory.

"Experience with Basic Bessemer Refractories" was the subject of the next Paper; this was given by Mr. D. Bird (Stewarts and Lloyds, Corby). Details of the evolution of re-lining practice for five 25-ton basic Bessemer converters producing weekly 12,500 tons of steel were given, it being stated that consistency of "life" was more important a value to synchronised steelworks practice than isolated cases of longevity. Originally, rammed dolomite with 60 per cent. tar had been used with quite good life, but use of increased silicon content in the metal had reduced this from 230 tons to 170 tons average. Modified practice had next demanded a shallower bath and a reduced lining thickness to hold the same metal. A stepped-back lining (with 3-in. steps) was then used, 18 in. of stabilised dolomite bricks, and a backing layer of rammed dolomite made up the total thickness. Despite the much thinner lining, an average life of 22.3 blows per lining was now obtained; this represented a very worthwhile saving, although re-lining now took 93 hrs. as against 73. Trials with up to 20 per cent. oxygen enrichment of

*As the conference proceeded, it became clear that an underlying obstacle throughout the deliberation were the wide divergencies both in cupola and converter practice which, in this and other examples, rendered the postulation of *standard* conditions virtually impossible of attainment, and which often vitiated the results obtained.—EDITOR.

Cupola and Converter Refractories

the blast had resulted in no deterioration of lining life. Converter bottoms were machine rammed with the dolomite mixture and pre-fired, their life was up to 50 heats.

Concluding the Papers of the first session was one by Mr. M. P. Newby (B.I.S.R.A.) on the "Aerodynamic Aspects of Refractory Wear and Converter Design." Here were shown models of converters made in transparent plastic, operated with liquids carrying air bubbles so as to render possible the photography of currents and turbulence, simulating those of actual practice. In trials with models of normal designs, the existence of a back eddy just above the tuyeres of the side-blown model was proved to correspond with a region of heavy "erosion" of the lining in actual works' practice. A modified design of converter, developed by the Author, and which embodied two sets of tuyeres almost vertically opposed, was shown in model form. It was said to eliminate back eddies of a harmful nature, and works' trials of this design would. it was hoped, be carried out in due course. During the general discussion which followed, Mr. Harrison expressed admiration of the courageous nature of the aerodynamics research which had been initiated and ingeniously pursued by B.I.S.R.A. He added that the *round* converters of the Stanton bomb plant, which were in contra-distinction to the normal D-shape, had given phenomenal lining life. Other speakers included Dr. White, Mr. Hampton (F. H. Lloyd & Company, Limited) and Mr. Topham (John Summers & Sons, Limited). Although some doubt was expressed as to the correct identification of conditions in the model with those of actual practice, general approbation was given for so unorthodox an approach to the problems of aerodynamics. (There were suggestions, later in the conference, that flow in cupolas might similarly be studied.)

Cupola Refractories

The second session of the conference opened with a Paper by Mr. W. J. Driscol (British Cast Iron Research Association) on "Modern Cupola Operation and Design at Home and Abroad." This Paper, though it revealed little new in British practice, gave a useful summary of trends in America and on the Continent. Among modifications described were American designs of cupolas, having an enlarged bosh diameter and with overhanging tuyeres (this was not widely adopted) and, separately, an enlarged well for extra metal capacity. Other general trends mentioned included the use of individually controlled tuyeres; thinner linings for standard cupolas; trials of basic refractories (for helping desulphurisation), and hot-blast cupolas. Cupolas were now often required to operate for 16-hr. periods and there was some indication that blast-furnace ideas were being followed closely.

The Paper by Dr. W. A. Archibald (B.I.S.R.A.) on "Operation and Refractory Wear in Cupolas" was also in the nature of a review of published information. Subjects on which comment was based were the possible uses of silica bricks and pre-formed unfired blocks in the cupola; the need for thin joints and good cement in bricking cupolas and the weakness of the monolithic lining between the fused inner and the green-bonded outer layers. There was said to have been no general improvement in methods and materials for cupola patching over a very long period, but literature had disclosed increased use of water-cooling of cupolas; that obtained by inserted blocks seemed to be the most efficient; of the basic refractories, stabilised dolomite was reported to be the best for cupolas.

Of great interest in the discussion following these two Papers were remarks by Mr. Renshaw (Ford Motor Company, Limited) on his firm's cupola design modifications to extend lining life and reduce patching. The first change was the incorporation of a decided step back in the lining profile at the region of maximum burn-out above the tuyeres. This had resulted in some saving, but wear on the exposed sharp corner had been heavy. In a further design, this corner was removed and the enlarged bosh was tapered to just below the tuyeres; this had resulted in a 60 per cent. saving in patching.

Points dealt with by other speakers elicited the information that cast-iron bricks in the upper part of the cupola stack were not very suitable for long runs; that slag analyses were not a reliable guide to the nature of lining wear unless the sample was taken from the walls; that life of patching and appreciation of a patching material were very much related to the operator who used them, and that there were possibilities in a "neutral" lining as distinct from acid or basic.

Foreign Experiences with Refractories

Two Papers, the first by Mr. Nicolas (*Centre Technique*) on "Experience from French Cupola Operation" (read by Mr. Rowe, B.I.S.R.A.), and the second "Experiences with Bessemer-Steel Foundries in Germany," by Mr. G. Klein (read by Mr. Smith), which formed the next section of the programme, were, in the main, complementary. The first-named quoted in great detail from recommendations made to French founders by their technical association about the lining and patching of cupolas. It stressed the development of acid monolithic linings and gave tabulated specific information as regards refractory constitution, particle size, clay content, degree of compaction, method of applying and lining dimensions. A feature was the emphasis on not-too-thick linings; a "thermal-equilibrium" profile at 6 to 8 in. was said to be ideal. Two examples of hot-blast water-cooled cupolas were described; the first had melted 10,000 tons of iron over a period of eight years without re-lining; and the second used a lining only 35 to 65 mm. (1.4 to 2.6 in.) thick, which was spray cooled. The German Paper was similar to the French in its main recommendations, differing only in the particular; for instance, the particle gradings for a composite monolithic acid refractory comprising quartz and a fireclay (blended artificially) used more of the smaller pieces of quartz and a finer grinding of the clay than was given by the French. Additionally, it was stated that bricks were often used in the upper portions of German cupolas, where the body was monolithic. Lining consumption was given as 65 to 70 kg. (143 to 154 lb.) per ton melted.

Converters in Germany were said to have followed a similar trend towards monolithic linings, though silica bricks were still used for parts most severely attacked. Comparable data were 50 to 75 charges for a 2-ton siliceous-brick-lined converter against 60 to 100 for a rammed lining.

Water-cooled Cupolas

"Water-cooling of Cupola and Tuyeres" was the subject of a Paper by Mr. W. H. Bamford (Austin Motor Company, Limited), which was delivered by the Author in a breezy style, but supported by much reliable data. He described the initial and final stages in the development of cupolas using water tanks in place of refractories for the melting zones. These tanks, 4½ in. deep, 22 in. wide and 30 in. high, were arranged only 1 in. apart around the inside circumference of the cupola above the tuyeres. They were made of cast steel ¼ in. thick with the back welded on; the front was corrugated and suitable water inlet and outlet connections were attached. In use, the tanks were backed by ganister and the corrugations in contact with the melt were filled with ganister. The cooling water reached 70 deg. C. normally, and sometimes boiled, but there was no observable decrease in metal temperature or increase in coke consumption. Tanks have outlasted two years' service. Brook water was pumped through the eight tanks per cupola at a rate of 64 galls. per min. (the Author did not disclose if this water was later used for central heating). A safety outlet was provided for each tank; if a leak developed, it was caulked until the week-end, when the tank was replaced.

Slag holes were similarly comprised of a cooling tank, but were arranged with a key-shaped hole, the tang of the key being filled with ganister and used as a reserve slag outlet. A thicker-section steel tank was used at the charging hole to take the impact of the falling charges.

The implications of the morning's Papers were summed up, briefly, by the Chairman, but discussion was limited by timetable considerations.

Miscellaneous Problems

The final session of the Conference was opened by Dr. G. R. Rigby (British Ceramic Research Association), who, in a Paper on "Developments in Foundry Refractories," outlined some of the possible lines for future improvement of the refractories *per se*. Amongst those discussed were:—(*a*) The prospect of producing quartz-type refractories where the crystobalite phase would be stable at room temperatures and would thus reduce danger from cracks; (*b*) the possibility of using the eutectic minimum (9 per cent.) of alumina in compounding siliceous refractories, and (*c*) the potentials of silicon esters or sols as bonds for making linings of unfired pre-cast blocks.

"Patching and Re-lining of Converters and Cupolas" was the next Paper; this was by Mr. H. Parnham (General Refractories). For acid converters, he considered a composite silica-brick/monolithic refractory, as elsewhere described, to be the most satisfactory. For a patching material, qualities of ramming, physical characteristics and method of application and drying had separately to be computed in devising suitable compositions. Storage recommendations and ramming methods were quoted; 3-in. steps for the latter in conjunction with the use of air-operated rammers and careful venting were advised. Slow drying over a period of three to seven days was essential.

Cupola patching material, more commonly known as wet, ground ganister, was described by the lecturer as the Cinderella of the industry, where price was the only ruling criterion for sales, and for which quality was subsidiary and subservient to methods of application. He deprecated the use of basic refractories in cupolas because of cost, saying that, unless a cupola could then run for a week without needing patching, basic refractories were too expensive for the average user.

A short Paper by Mr. B. Vassiliou (Sheffield University) followed. This was devoted to the drying of refractories, and formulæ were presented for the conditions of drying as functions of the ruling vapour-pressures. A novel feature was the disclosure of theoretical advantages of drying from the outside shell inwards to the air face. [Perhaps this is why cupola and converter patching while the body of the furnace is warm has long proved to be a successful method.]

A précis of salient points from the Papers of this last session was undertaken by Dr. A. H. B. Cross (Brown-Firth Laboratories), Dr. Rigby having taken over the duties of chairman. Dr. Cross is also chairman of the Side-blown Converter Refractories Sub-Committee of the Iron and Steel Institute, and from that office he deprecated the inability to carry out experiments under standard conditions or, indeed, to formulate any set of conditions which were equally fair to any group of refractory materials. He thought the major difference between the developments for cupolas and converters was that no water-cooling had been tried with converters. Thin linings and water cooling were, he said, complementary, but the efficiency and heat conservation must not be forgotten. Considering some of the proposals made during the conference, he said he would like to hear of the neutral refractory—carbon—being tried in cupolas. Magnesite as a refractory in cupolas could be ruled out, as there was a possibility of its reduction with formation of magnesium fumes. There were, he believed, developments which might be foreshadowed by studying the aerodynamics of both cupolas and converters. Fused silica might be used at some future date as a furnace refractory. The chief tendency to-day for improved results was to produce a higher concentration of silica per unit volume of furnace lining. As a final injunction to the makers of refractories, he seriously requested their efforts towards improvement of quality, and added, in a humorous aside, that if Mr. Bamford's lead in the direction of water-cooling was followed, we might soon be using furnaces with little or no refractory.

In the short discussion which followed, Mr. H. Field (John Harper & Company, Limited) said he was startled to hear it said that no progress had been made with cupola patching for a very considerable period, but agreed that the man actually on the job was all important; it was necessary that he be trained and properly supervised. Mr. Bamford said his firm had experi-

Cupola and Converter Refractories

mented with furnace-electrode carbon blocks in both the melting zone and bosh of cupolas, but they had rapidly burnt away. Another neutral refractory, chrome magnesite, also had been tried, but in this case there was contamination of the melt by chromium. Silicon ester was condemned as a common refractory bond on the ground of expense.

The proceedings terminated with an expression of thanks from the Chairman to Dr. Newell, of B.I.S.R.A., and his staff who had organised so successful a gathering. Delegates identified themselves unanimously with this resolution. Dr. Newell, in reply, thanked the lecturers and impromptu speakers and apologised for the curtailment of the time available for discussions. At future conferences, he said, more time for general discussion would be allowed.

New Foundry Amenities at Falkirk

(*Continued from Page* 464)

complete and would be at the disposal of employees on Monday morning. He hoped everything would be to their liking and that the new and improved conditions would give them increased happiness and pleasure in their work.

Mr. Mitchell said that it was a matter of great satisfaction to himself and his co-directors to know that an excellent feeling of comradeship and loyalty existed in Grahamston Iron Company. The directorate was prepared to do everything possible to improve the conditions in the works, and any suggestions from the employees would, as always, be carefully considered and, if found practicable, acted upon. Before asking his sister to declare the canteen and baths-room open, Mr. Mitchell thanked all those who had assisted in any way with the erection and equipping. After declaring the premises open, Miss Mitchell was presented with a handbag.

Mr. Henry Wilson said it was exactly 81 years since the foundry was established by the father of the Mitchell brothers. It was a very small concern at first, but under careful management it had gradually gone from strength to strength until to-day it was a very large and important industrial concern. The business had been built up by enterprise and foresight, and had been enlarged and improved to a considerable extent. Up-to-date plant and machinery, he continued, had been installed, and the works had been considerably extended, the latest development being the new scheme which was a credit to the company, and he hoped it would prove a great comfort to the men who were going to use the facilities. The Mitchell brothers were not absentee employers, but were indefatigable in the attention they gave to the work of the foundry. There were very few men who put in a harder day's work. Mr. Walter, while he had many commercial and industrial duties to perform, found time for showing an interest in welfare work, and Mr. William was always ready to give his wise advice on any problem which arose.

Corebox Causes Scrap

By "Coroner"

A simple defect can often be the cause of a considerable number of wasters before it is discovered and rectified. A particular casting, usually made in batches of fifty, was continually passing through a certain shop without any undue trouble until suddenly a number were found to be defective due to unequal metal thickness. The peculiar thing about the trouble was that it varied so widely; some of the batch would be perfect, whereas others would be anything up to $\frac{1}{4}$ in. out of centre, which on a thickness of $\frac{5}{16}$ in. was very bad.

Undue clearance in the coreprints, thus permitting core misplacement, was at first suspected. This could easily be the cause of the trouble experienced, as the particular part of the casting which was defective was formed by means of a core suspended from the top box and thus the moulder could not inspect the thickness around the sides when closing. This thickness could be checked by "clay-thicknessing," an operation costly in time and not warranted if the pattern equipment were correct. On inspection, the print was found to be ideal for the core, and the cause had to be sought elsewhere.

The core was made in a frame corebox located on a bottom, from which a fillet was cut, the piece forming the shape of the core and also the print portion being fitted into the frame, which was kept together by bolts. When on another mission to the coreshop, the casting inspector—who had been worried about these occasional wasters which had no logical explanation—noticed the coremaker making the particular core, and was struck with the ease by which all the parts came out of the box without any loosening of the bolts. On looking into the matter further, he found the top part forming the print portion had shrunk—due to storage and use in varying temperatures—to the extent of $\frac{1}{8}$ in. and was thus free to move by that amount.

This solved the problem, for if the loose piece were kept close against one edge for one core and the other edge for the next and central for the third, this would account for some castings coming right, and those that were wrong varying from side to side. The coremaker had not reported the matter to the pattern shop as he could manipulate the box much more easily with this piece slack, little thinking that this simple happening was causing much unnecessary scrap.

MR. ROBERT FOOT, chairman of the Powell Duffryn Technical Services, Limited, speaking at a meeting of the London Fuel Luncheon Club on May 17, stated that if the industrial coal purchased in 1948 had been bought at 1935 prices, the purchasers would have paid £217,000,000 less. He added that the various mechanisation schemes envisaged would, at the present level of wages, only reduce the cost of production by 5s. a ton by 1965.

Pattern Storage

An Orderly Approach to a Difficult Problem

By C. W. C. White

One of the major problems of every foundry, and particularly those engaged on jobbing work, is the question of pattern storage. The solution to this question is apparently so difficult that few firms attempt to arrive at one, and in many cases the stores are purely "dumps." The fundamental necessities for pattern storage are:—(1) Maximum accommodation in a minimum of space; (2) easy location of any particular item, and (3) handling of equipment to be reduced to a minimum. Owing to the diversity of requirements of various firms, this article does not aim at laying down any hard-and-fast rules, but merely outlines the various aspects of the situation.

In order to economise on building space, the obvious approach is to ensure that only patterns which are used for current production should be retained by the manufacturing foundry, and it is felt that the owners of the equipment should be responsible for the storage of a larger percentage of their patterns than is normally the case at present. Many foundries have much useful room wasted due to the harbouring of obsolete patterns or obsolescent equipment, so as to cater for spares required, possibly, at some future date. When the foundry has to carry out this policy for perhaps thirty or forty of its customers, the point becomes a serious one.

The regular return of patterns to the parent firm after the completion of a batch of castings has much to commend it, as in this way the owners can ensure that the patterns are maintained in first-class condition and also, should a "special" be required, it is better for them to have the equipment to hand rather than have to make hurried transport arrangements for its return. Another point also is that the fire hazard is reduced at the foundry end, as the amount of patterns stored is reduced.

Allocation of Space

The method of allocating storage space should receive much more thought than at present; some firms segregate the patterns of their various customers in certain sections of the stores, but this method gives rise to certain objections. It is not economical to mix objects of different sizes and eventually the time comes when all of one storage area is occupied and a section is started in another part of the stores for the same firm. Another fault is the retention of patterns with their appropriate coreboxes, a desirable notion in theory but a poor one in practice. Patterns and coreboxes are destined for different departments and, therefore, it is better to have separate stores adjacent to the ultimate destinations. Owing to their frequently regular external shapes, coreboxes can be more economically stored together than when mixed with patterns. It is generally accepted that articles grouped into similar sizes can be stored in an easier manner than is possible when large and small articles are mixed.

In a jobbing foundry engaged on a certain class of work such as machine tools, internal combustion engines, textile machinery, etc., it may be found convenient to group patterns according to similarity. For instance, such parts as flanges, glands, brackets, levers, cylinder heads, manifolds, crankcases, flywheels, pulleys, gear blanks and the like could each be allocated to certain sections of the stores. Thus, all flywheel patterns would be stored together irrespective of their ownership. Another useful factor is that this method facilitates the easy comparison of similar articles for cost or manufacturing purposes.

Pattern Bins

Pattern stores are usually regarded as a necessary evil and little thought of expense is given to these most important items. The vexatious delays due to damaged or mislaid patterns due to inadequate storage equipment are only too widespread. For the smaller type of pattern, well-made bins, arranged in tiers, are better than shallow racks; these should be in steel. There is on the market a series of sectional nests of bins which may be built-up in units to suit individual needs. These range in size from 24 in. square to 6 in. square (see Fig. 1). Where these are built with larger sections at the bottom, the difficulty of shadows is much reduced. Another useful type has deep drawers which tilt to facilitate easier inspection when pulled out. (Fig. 2.)

It is generally desirable to have a single-storey building—human nature being what it is—otherwise there is always a tendency to leave patterns on ground level until an opportunity occurs for them to be taken up aloft.

Pattern Plates

Where a variety of moulding machines is installed,

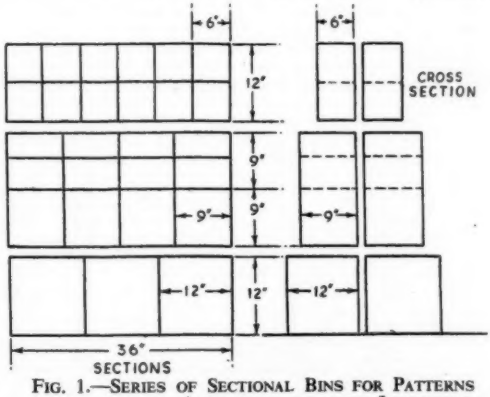

FIG. 1.—SERIES OF SECTIONAL BINS FOR PATTERNS (THESE CAN BE ASSEMBLED TO SUIT INDIVIDUAL NEEDS).

Pattern Storage

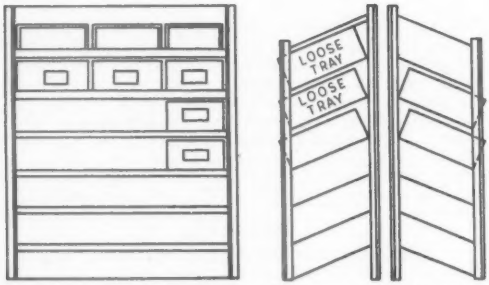

FIG. 2.—PULL-OUT TILTING DRAWERS WITH LOOSE TRAYS.

an accumulation of pattern plates is inevitable, and the simplest way is to segregate these according to the particular machines to which they are restricted. The best method of storage is to erect horizontal bars between the stanchions, in tiers, and to suspend the plates by "S" hooks inserted in one of the pinholes. The plates are thus presented edge on; these edges can then be suitably labelled. No weight is placed on the pattern itself and a minimum of space is needed.

Bulky Patterns

The biggest problem of all is, of course, the large, bulky job. It is very difficult to devise a method of lifting these for storage at a level above ground; this results in their being dumped on the floor, thus wasting space. In this connection, it is worth while considering the use of certain types of stacking trucks as a means of elevating the pattern to the required height and then sliding it into tiered racks (Fig. 2). The electric- or petrol-driven stacker can lift up to 2 tons to a height of 10 ft. and needs very little gangway room in which to operate. Another machine which is very useful is a portable jib crane, as the wall-type jib is very restricted in its application.

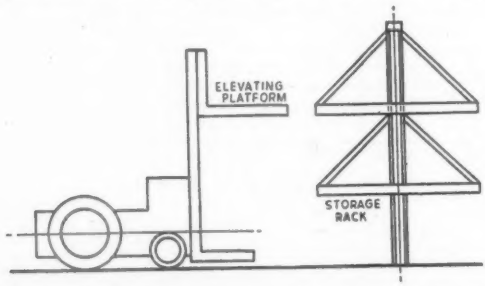

FIG. 3.—DIAGRAMS SHOWING THE USE OF AN ELEVATING TRUCK FOR PATTERN STORAGE.

Where it is essential for a large pattern to be stored on the floor, there is a type of truck designed for shifting machine tools which may prove of interest. This is an elevating truck in which the platform drops to floor level at the front to enable it to be inserted under the lowest article. This is much more adaptable than the usual type of elevating truck. If the pattern be stored on small blocks, the use of a truck of this type cuts out the risk of damaging the article through having to haul it until an overhead crane could be brought into use. Another awkward item is a range of heavy pattern boards for the larger machines. These, also, should be stacked on edge and a simple way of ensuring their easy withdrawal is to load them on short pieces of roller conveyor mounted on the ground (see Fig. 3). The pattern boards are then kept vertical by horizontal bars. Lengthy patterns of narrow section also give rise to much trouble, and it is suggested that a tip be taken from the steel merchants and an attempt be made to store these on end. The main difficulty is to tilt the object and, here, the portable jib crane would help. The only point to watch is to ensure that the pattern is robust enough to withstand this treatment.

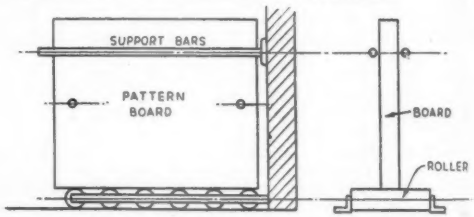

FIG. 4.—METHOD FOR STORING LARGE PATTERN BOARDS.

It is hoped that the foregoing remarks will form a basis for additional suggestions in overcoming one of the difficulties in pattern storage with which the industry is at present faced.

THE PRODUCTION, PROPERTIES AND APPLICATIONS of nodular graphitic grey cast iron was featured at the 53rd Annual Convention of the American Foundrymen's Society. It was sponsored jointly by the Grey Iron and Malleable divisions of A.F.S. on Tuesday, May 3, in the Gold Room of Hotel Jefferson, St. Louis, where the Congress was held this year. Included in this symposium was a Paper presented by Mr. D. J. Reese, International Nickel Company, on the subject, "Spheroidal Carbon Cast Iron," followed by a discussion of this subject by Mr. Gosta A. Vennerholm (Ford Motor Company, Dearborn, Mich.); Mr. R. G. McElwee (Vanadium Corp. of America, Detroit); and Mr. C. K. Donoho (American Cast Iron Pipe Company, Birmingham, Ala.).

Management in the Ironfounding Industry

The Council of Ironfoundry Associations held its second Management Conference at Ashorne Hill, near Leamington Spa, on May 5 and 6. Nearly a hundred managers and other executives attended, and the new Chairman of the Council, Mr. N. P. Newman (Newman, Hender & Company, Limited), presided. In conjunction with the Conference, an exhibition of protective clothing suitable for ironfoundry workers was arranged by the Factory Department of the Ministry of Labour. The four sessions of the Conference covered the subjects of productivity, human relations, amenities and marketing.

Productivity

The first speaker, Mr. C. D. Hunter (Stevenson, Jordan & Harrison, Limited), spoke on "Productivity and Profit—A Job for Management." In a survey of the principles involved, he stressed the increasing need for industrialists to adopt improved methods to achieve quality and increased production, and he said that many leading concerns had instituted a separate function in their organisations for this purpose and had reaped an adequate reward. Quality and increased production were complementary. This was especially true in the ironfounding industry, where the elimination of wasters contributed directly to increased production. Mr. Hunter dealt with the development of "work measurement," as a means of enabling production control to function effectively, as a basis for reliable costing, and as a method of providing an incentive to the workers. He emphasised the value of such incentive schemes in attaining satisfactory production and high morale of workers, if there were honesty of purpose in respect of both management and workmen, and all time studies were made available to the former, showing relaxation for fatigue, personal needs, etc. Mr. Hunter also noted the "preventive maintenance" which mechanisation called for, and on the subject of costing he spoke of the accurate control of expenditure through flexible budgets and the application of standard costs, indicating that reliable cost information can further the sales effort and provide the greatest profit.

Colonel W. A. Grierson, D.S.O. (Hayeshaw, Limited), following Mr. Hunter, explained in a graphic manner how the Lancashire cotton industry, benefiting from the experience with work measurement gained, between the wars, in certain European countries, is developing work measurement, standard costs, production planning, flexible budgets and cost control. He finished his survey by referring to the re-deployment which was now being put into effect.

Human Factors

The second session dealt with human factors in industry. The Chairman had already mentioned, in opening the conference, that the greatest problem in industry to-day was the human problem, and the first speaker in the session, Dr. C. B. Frisby (Director of the National Institute of Industrial Psychology) made the point at the outset that "human relations" must be interpreted literally as relations between real people. Abstract concepts of management and personnel could cloud our thinking. Good relations had a positive character— absence of discord was not a sufficient criterion—evidenced by the will to co-operate Human relations in industry depended on the attitudes of people to each other and to their work. Attitudes were affected not only by personal qualities but by history and tradition, social and economic factors, and physical and psychological aspects of the working environments. Dr. Frisby dealt in turn with all of these. He concluded by saying that managers must be ready to take the lead in developing better relations—their attitudes would largely determine the rate of progress.

Mr. H. Weston Howard, C.B.E. (Hayward, Tyler & Company, Limited, Luton), introducing the discussion, gave an account of how joint consultation had been applied in his own company over the past 15 years. He made clear that any suspicion between workers and management could be banished by complete frankness. He corrected the mistaken idea that joint consultation required a management to give up its managerial prerogative. Committees were useful for advice and for policy making, but were not good for executive use. The two principles that Mr. Howard thought should be used in joint consultation were: (1) Management must always manage—it could not give up its responsibilities to the workers; and (2) consultation should always take place between one rank and the next above it. He described the pyramid structure of the committees in his organisation, with the Joint Production Committee at the bottom level and the Policy Committee at the top of the pyramid. This Policy Committee would discuss everything—including profits. Mr. Howard closed by affirming that to obtain the best human relations we must have some spiritual strength behind us.

Sanitary Blocks

The third session dealt with the installation and conduct of sanitary blocks, which are becoming increasingly numerous in the industry. A round-table discussion under the chairmanship of Mr. J. W. Gardom (John Gardom & Company) took place between representatives of equipment manufacturers, ironfoundry owners and professional advisers. They were agreed that the siting of a sanitary block in a works was an important factor in determining the degree of use, and that it should be between the foundry and the main works entrance, and, for economy, be operated in conjunction with the canteen. Recommendations and individual preferences in connection with construction, lay-out, conduct and maintenance were expressed by the different speakers from their special viewpoints. Some guidance was also given as to the extent of use that the management might reasonably anticipate while a centre was still in the planning stage. Finally, the discussion group agreed that good sanitary blocks could attract labour into the industry and also help to put up the rate of production.

Management in the Ironfounding Industry

Selling Iron Castings

In the last session Mr. W. H. Harper (John Harper & Company, Limited) dealt with selling methods applied in the industry. He referred particularly to press advertising and the sales representative. He examined various advertising techniques which had been successfully employed in the past and declared himself now in favour of the advertisement which confined itself to one idea or one product. Most convincing was the advertisement in which the ironfounder could link his own name with that of a satisfied customer whose trade-mark was well known. Mr. Harper's address was supplemented by a short Paper from Mr. C. J. Lake (Lake & Elliot, Limited), who stated that there was only one idea that consistently sold castings, and that was "good castings." A sales organisation must have confidence in the product it had to sell. To increase the industry's overall sales of castings, the general standard from all foundries must be improved. Where sales representatives were employed they should have a technical background, be thoroughly schooled in their company's production methods, and have a working knowledge of design problems. The representative should not be considered only as a salesman; he should follow the castings right the way through to final machining and report progress. Mr. Lake described the types of advertisement which he thought were successful, and others which were not, and in agreement with Mr. Harper he advised against trying to make a single advertisement cover too large a field.

Protective Clothing

The exhibit of protective clothing was arranged with the co-operation of H.M. Chief Inspector of Factories, and included a variety of items for eye, face, hand, foot and body protection. Mr. E. W. Murray (Curator of the Industrial Safety Museum) was in attendance and gave some very useful advice on the value and use of this equipment.

Bradford Society's Annual Dinner

Speaking as a guest at the jubilee dinner of the Bradford Engineering Society, held at the Great Northern Victoria Hotel, Bradford, on May 6, the Lord Mayor of Bradford (Ald. F. J. Cowie), himself a member of the Society for 35 years, once more expressed his doubts whether the right policy was being pursued by sending new textile machinery to competitors abroad before that in this country could be reconditioned. He said that it appeared they were exporting the type of machinery which would be best to make dollars, but much could be said for "putting our own house in order first."

THEIR ROYAL HIGHNESSES The Princess Elizabeth and the Duke of Edinburgh have graciously consented to extend their patronage to the Fourth World Power Conference, to be held in London at the invitation of the British National Committee from July 10 to 15, 1950.

Apprentices' "Busman's Holiday"

On April 27, forty apprentices from various foundries in Lancashire visited the works of the National Gas and Oil Engine Company, Limited, at the invitation of the foundry manager, Mr. Haynes, a gesture made in appreciation of their efforts in a recent Essay Competition originated by the Lancashire Branch of the Institute of British Foundrymen.

Welcomed on arrival by Mr. van der Ben, the foundry superintendent, and Mr. Haynes, they were conducted through the works, but the foundry and pattern shop were the main attraction. Great interest was shown in the Hydro-Blast plant, the sand-handling plant, the different groups of moulding machines and other methods of producing large castings in green-sand moulds.

After the tour of the works, Mr. Wood, the works manager, said he considered them all as "something special," and was pleased that they had taken advantage of the invitation to visit the works, and that their aptitude and keenness would ultimately re-act not only to the advantage of themselves in particular but also to the foundry trade in general.

In conclusion, Mr. Haynes—the Foundry Manager—declared himself in favour of the exchange of information, and reminded them that the introduction of machinery in foundries did not necessarily tend to eliminate the skilled craftsman, a demand for whom would, in his opinion, always be prevalent.

Proposing a vote of thanks, an apprentice from Mather & Platts, of Manchester, who won the first prize in the competition, remarked that more visits of this kind to other works would be advantageous to them all, and his views were endorsed by an apprentice from Grayson and Rollo Dock, of Liverpool, who won the second ptize in the competition.

Publication Received

Murex, Limited. By this firm, from Rainham, Essex.

This brochure tells of the uses of the rather exotic products of this company. After a short historical introduction, the industrial applications of tungsten, vanadium, molybdenum, chromium, copper, titanium, manganese, aluminium (powder), nickel, tantalum, columbium, boron and cobalt and their alloys are outlined. These metals are prepared in the condition best suited for the market; thus some are sold as the pure metal, whilst others are as ferro-alloys. Penultimately there are some notes on powder metallurgy, whilst the brochure closes with a short description of the work undertaken by Murex Welding Processes, Limited, a subsidiary company. The illustrations which have been used are striking, and have been well chosen, the front cover being particularly impressive. This brochure also appears both in French and Spanish, and overseas and home readers will find it a useful introduction to sources of metallurgical products, some of which are not always too easy to locate.

Parliamentary

Reopening of London Metal Exchange

At question time on May 9, AIR-COMMODORE HARVEY asked the Minister of Supply if he was now able to make a statement regarding the opening of the London Metal Exchange. MR. STRAUSS replied: "No, sir." He later intimated that the question of the opening of the Metal Exchange was under review. After further questions AIR-COMMODORE HARVEY said that, in view of the "very unreasonable attitude of the Minister," he begged to give notice that he would try to raise the matter on the adjournment at a very early date.

After Mr. Strauss's initial reply, AIR-COMMODORE HARVEY asked if the Minister was aware that his attitude in this matter was responsible for lead being something like £37 a ton and zinc about £31 a ton higher in price in this country, and why did he not realise that "this extraordinary attitude of mind" was the greatest handicap producers could have in selling their goods abroad.

MR. STRAUSS: "I do not accept the implications in that question a bit. If it were not for the fact that we have been bulk purchasing metals, many of our manufacturers would have been without their raw materials."

MR. DAVID ECCLES asked if, in view of the fact that H.M. Government was losing millions of Marshall dollars because of the contract prices for the second quarter for 4,500 tons of lead, 18,000 tons of copper and 18,000 tons of zinc, all purchased at prices well above existing world prices, the Minister would reconsider this matter.

"No, sir, I still do not accept the implications put forward by the hon. Member," MR. STRAUSS replied. "However, the question of the opening of the Metal Exchange is under review, but I have no statement to make about it at the moment."

MR. MARTIN LINDSAY then asked if the Minister was aware that the prices of a number of British goods were now well above world prices for no other reason than that manufacturers could not get their raw materials at world prices, to which MR. STRAUSS retorted: "I think the number of goods concerned would be very small indeed."

MR. W. FLETCHER: "Is the Minister aware that when he was talking about the Liverpool Cotton Exchange recently he said that its reopening and the extension of its use were under consideration, and would he now, after all these years, stop merely considering and open the Metal Exchange?"

MR. STRAUSS: "I never made any remark about the Liverpool Cotton Exchange."

Right to Work a Patent

When the Patents and Designs Bill was considered by the Lords in Committee on May 10, the Government accepted an amendment moved by VISCOUNT SWINTON that a patentee who did not immediately work a patent should have a period of grace of three years before anyone else should have the right to work it.

Colvilles' Works Developments

Two-year Plan

"The extensions of the coke ovens at Clyde Iron Works will enable the company to produce all the coke it requires," says Sir John Craig, chairman of Colvilles, Limited, in a statement circulated with the annual report. "We have been assured by the National Coal Board that additional supplies of coking coal are available in Scotland. The extension of the melting capacity at Clydebridge Steel Works will absorb the greater supplies of coke-oven and blast-furnace gas and so will keep these works in balance as an integrated unit. It will be two years before these schemes can be completed."

Sir John states that the company has taken out a licence to convert its blast furnaces for high-pressure operation following investigations into the results obtained from the process in the U.S.A. The first opportunity for converting a furnace will be taken when it is closed down for relining early next year. Substantial improvement in the output of pig-iron will, it is hoped, result from this change.

"The further development of the company's production must be related to market conditions and the state of the industry in general," says Sir John. "A sound steel industry can only be built upon ample supplies of pig-iron, based on sufficient coal and iron ore. I would like to comment on the question of expansion as it affects the Scottish steel industry. You have seen frequent reference in the Press to the suggestion that the expansion of steelmaking should be carried out at some deep-water site on the River Clyde. We have naturally given such a proposal our most careful consideration. The suggestion had, in fact, been considered 20 years ago by the iron and steel makers in Scotland as a body, but it did not get any support. However, the proposal was reviewed by your directors in the light of conditions to-day, and they came to the definite conclusion on economic grounds, that the scheme could not be justified."

The following summary of group production for 1948 is made in the report:—IRON AND STEEL: Pig-iron, 523,016 tons; steel ingots, 1,736,468 tons; steel plates and sheets, 597,978 tons; steel sections and bars, 549,519 tons; steel slabs and billets, 472,973 tons; steel castings, 6,939 tons; iron castings, 34,937 tons; bright steel bars, 23,020 tons; galvanised sheets, etc., 34,715 tons. OTHER PRODUCTS: Coke, 316,931 tons; tar, 20,138 tons; sulphate of ammonia, 6,598 tons; naphthalene, 105 tons; basic slag for farms, 25,514 tons; slag for buildings, 37,550 tons; slag for roads, 82,627 tons; limestone, etc., for agriculture, 9,698 tons; crude benzole, 1,432,410 galls.; building bricks, 16,055,275 tons.

The average number of employees was 16,880. The sum of £6,480,953 was paid in wages, salaries, national insurance, superannuation and other social services (before deduction of income tax), excluding directors' remuneration, the average received per employee last year being £386.

British Blast Furnaces in the March Quarter, 1949

These tables are published through the courtesy of the British Iron and Steel Federation.

Derby, Leicester, Notts, Northants and Essex.

Name of firm.	In blast, April 2, 1949, making :—				Weekly average in blast.		Total built.	Furnaces relining.
	Hematite.	Forge and foundry.	Basic.	Total.	March 1949 quarter.	Dec. 1948 quarter.		
Clay Cross	—	1	—	1	1	1	2	—
Ford Motor	—	1	—	1	1	1	1	—
Kettering Coal & Iron	—	2	—	2	1·8	1	2	—
New Cransley Iron & Steel	—	1	—	1	1	1	2	1
Renishaw Iron	—	2	—	2	2	2	2	—
Sheepbridge	—	1	—	1	1	1	1	—
Stanton Ironworks : Holwell	—	3	—	3	3	3	5	1
Stanton-by-Dale	—	3	—	3	4·8	5	5	2
Staveley Iron & Chemical	—	4	—	4	4	4	4	—
Stewarts and Lloyds : Corby	—	—	4	4	4	4	4	—
Wellingboro' Iron	—	1	1	2	2	2	3	1
Total	—	19	5	24	25·6	25	31	5

Lancashire (excl. N.-W. Coast), Denbigh, Flint and Cheshire.

Brymbo Steel	—	—	1	1	1	1	1	—
Darwen & Mostyn	—	—	—	1*	1	1	1	—
Lancashire Steel Corp'n.	—	—	2	3†	3	3	4	1
Total	—	—	3	5	5	5	6	1

* Producing ferro-manganese. † Includes one producing ferro-manganese.

North-West Coast.

Barrow Hematite	2	—	—	2	2	1·9	4	1
Charcoal Iron	—	1	—	1	1	1	1	—
Millom & Askam	2	—	—	2	2	2	3	1
United Steel : Workington	2	—	—	2	2	2·3	3	1
Total	6	1	—	7	7	7·2	11	3

Lincolnshire.

Appleby-Frodingham	—	—	8	8	8·5	9	9	1
Lysaght, J. : Scunthorpe	—	—	4	4	3·7	3	4	—
Thomas, R., & Baldwins : Redbourn	—	—	2	2	2	2	2	—
Total	—	—	14	14	14.2	14	15	1

North-East Coast.

Cargo Fleet Iron	—	—	2	2	2	2	3	1
Consett Iron	1	—	1	2	2	2	2	—
Dorman, Long : Acklam	—	—	3	3	3	3	4	1
Redcar	—	—	2	2	2	2	2	—
Cleveland	—	—	2	2	2·8	3	5	—
Bessemer	—	—	2	2	2	2·5	3	1
South Bank	—	—	—	2*	2	2	4	—
Grangetown	—	—	—	—	—	—	2	—
Gjers, Mills & Co.	2	—	—	2	2	2	5	—
Pease & Partners	2	—	—	2	2·2	3	3	1
Skinningrove Iron	—	—	2	2	2	2	2	—
South Durham Steel & Iron	—	—	2	2	2	2	3	—
Total	5	—	16	23	24	25·5	38	4

* Producing ferro-manganese

Scotland.

Bairds & Scottish Steel : Gartsherrie	1	1	1	3	3	3	5	1
Carron	—	1	—	1	1	1	1	1
Colvilles	—	—	2	2	2·2	3	3	1
Dixon's	—	2	—	2	2	2	6	1
Total	1	4	3	8	8.2	9	18	4

Kyanite Production in Kenya

The Economic Co-operation Administration Mission to the United Kingdom announced on May 9 approval of a plan to assist in the expansion of kyanite production in Kenya. Kyanite is an aluminium silicate used to make refractories which can withstand high temperatures and resist thermal shock. Its main use is in high-temperature furnace linings. E.C.A. will provide $72,000 for purchase in the United States of mining machinery for Kenya Kyanite, Limited, which will be able to raise production from 25,000 to 37,000 short tons annually. The increased production for a three-year period, totalling 36,000 tons, will be sold to the United States for its national stockpile.

The E.C.A. dollars will be given to the British Government, which will lend the money, through the Kenya Government, to the company. The company will repay the British Government in sterling out of the purchase price for the kyanite. This $72,000 sum is provided to the British Government by E.C.A. on a direct grant basis, not as a loan, and is in addition to the normal procurement authorisations for E.C.A.-financed commodities for the United Kingdom.

India has been the principal source of high-grade kyanite in the past, but supplies from that area are uncertain because of transportation difficulties.

Nationalisation Advocates Challenged

Sir Frederick Bain on Steel

Sir Frederick Bain, the retiring president of the Federation of British Industries, speaking at the Federation's annual meeting in London on May 11, issued a challenge to advocates of nationalisation to bring forward any instance in which privately owned industry had attempted to thwart post-war achievement of national objectives or disregard national responsibilities. He emphasised the F.B.I.'s desire to uphold its non-political outlook irrespective of whatever Government was in power, but he claimed that the Federation would be betraying its trust if it failed repeatedly and emphatically to raise its voice in protest against State control of steel.

Sir Frederick said: "The nationalisation of a great basic industry, such as steel, vigorous in its plans for development, efficient in its conduct, alive to the need for scientific research, and enjoying harmonious relations between its managements and workers, is something far transcending party politics, and affects the wellbeing of our whole economic life.

THE DEVELOPMENT DEPARTMENT of Alar, Limited, 35, New Broad Street, London, E.C.2, is moving to larger premises at 3, Albemarle Street, London, W.1 (telephone: Mayfair 2901), on June 3.

British Blast Furnaces in the March Quarter, 1949—*cont.*

Staffordshire, Shropshire, Worcestershire and Warwickshire.

Name of firm.	In blast, April 2, 1949, making :—				Weekly average in blast.		Total built.	Furnaces relining.
	Hematite.	Forge and foundry.	Basic.	Total.	March 1949 quarter.	Dec. 1948 quarter.		
Goldendale Iron	—	1	—	1	1	1	2	1
Grazebrook Cold Blast	—	—	—	—	—	—	2	—
Lilleshall	—	1	—	1	1	1	2	1
Round Oak Steelworks	—	1*	—	1	1	1	3	—
Shelton Steel & Iron	—	—	3	3	3	3	3	—
Stewarts and Lloyds : Bilston ..	—	—	3	3	3	2.8	3	—
Thomas, G. & R.	—	—	—	—	—	—	2	—
Total	—	3	6	9	9	8.8	17	2

* Cold-blast pig-iron.

South Wales and Monmouthshire.

Guest, Keen, Baldwins :								
Briton Ferry	1	—	—	1	1	1	1	—
Cardiff	1	—	2	3	3	2.7	4	1
Steel Co. of Wales : Margam ..	—	—	2	2	2	1.9	2	—
Thomas, R., & Baldwins : Ebbw Vale	—	—	2	2	2	2	3	1
Total	2	—	6	8	8	7.6	10	2

Sheffield.

Park Gate Iron & Steel	—	—	1	1	1	1	2	—
GRAND TOTAL	14	27	54	99•	102	103.1	148	22

•Includes four making ferro-alloys.

Number of Furnaces in Blast on April 2, 1949

District.	Weekly average in blast, March quarter.	Total in blast, April 2, 1949.	In blast April 2, 1949, making :—			
			Hematite.	Forge and foundry.	Basic.	Ferro-alloys.
Derby, Leics., Notts., Northants and Essex ..	25.6	24	—	19	5	—
Lancs. (excl. N.-W. Coast), Denbigh, Flint and Ches.	5	5	—	—	3	2
Lincolnshire	14.2	14	—	—	14	—
North-East Coast	24	23	5	—	16	2
Scotland	8.2	8	1	4	3	—
Staffs., Shrops., Worcs. and Warwick	9	9	—	3	6	—
S. Wales and Monmouth	8	8	2	—	6	—
Sheffield	1	1	—	—	1	—
North-West Coast	7	7	6	1	—	—
Total	102	99	14	27	54	4

Weekly Average Number of Furnaces in Blast during the Previous Six Quarters

District.	1948.				1947.	
	Dec.	Sept.	June.	March.	Dec.	Sept.
Derby, Leics., Notts., Northants and Essex ..	25	25.6	25.7	25.4	24.3	25.8
Lancs. (excl. N.-W. Coast), Denbigh, Flint and Ches.	5	5	5	5	4.7	3.9
Lincolnshire	14	13.5	13.8	13.7	13	11.4
North-East Coast	25 5	25.2	25.2	25.7	25	23.7
Scotland	9	9	9	9.1	8.5	8
Staffs., Shrops., Worcs. and Warwick	8.8	8	8	8	7.1	6.2
S. Wales and Monmouth	7.6	7.8	7.7	7	6.9	6.9
Sheffield	1	1	1	1	1	1
North-West Coast	7.2	6.3	6.4	7	7	6.3
Total	103.1	101.4	101.8	101.9	97.5	93.2

The following companies have furnaces in course of construction :—Darwen & Mostyn, 1; Lancashire Steel Corporation, 1; Steel Co. of Wales, 1; Sheepbridge Company, 1; Consett Iron, 1, and Skinningrove Iron, 1.

Personal

SIR JOHN MORISON has been elected to the board of Guest, Keen & Nettlefolds, Limited.

MR. R. H. R. GRAYSON, assistant managing director, has resigned from the board of Grayson, Rollo & Clover Docks, Limited, Liverpool.

MR. W. W. MACARTHUR has been elected a director of Craven Bros. (Manchester), Limited, machine-tool manufacturers, ironfounders, etc., of Reddish, Cheshire.

MR. JOHN F. WEBSTER, who retired two years ago from his position as foundry manager of Douglas Fraser & Sons, Limited, Arbroath, is the new Provost of that town.

MR. SLATER WILLIS, managing director of the Tinsley Rolling Mills Company, Limited, Sheffield, has received a presentation in recognition of his 50 years' service with the company.

MR. R. D. BURN, MR. V. GERSTENBERG and MR. H. D. THOMAS have been appointed to the board of Hudson & Wright, Limited, seamless-tube manufacturers, of Birmingham.

MR. JOHN O. CRABTREE, managing director of R. Hoe & Company, Limited, Borough Road, London, S.E.1, has been elected chairman of the British Association of Manufacturers of Printing Machinery.

MR. HUGH SANDS, managing director of Arthur Green, Limited, ironfounders, of Old Whittington, Chesterfield, is reported to be making satisfactory progress following an operation for appendicitis.

MR. HERBERT EDWARD HILL, chairman of Richard Hill & Company, Limited, steel wire-rod rollers, etc., of Middlesbrough, has been appointed a director of Hayden-Nilos, Limited, conveyor-belt fastener manufacturers, of Sheffield.

MR. LESLIE GAMAGE, vice-chairman and joint managing director of the General Electric Company, Limited, has been elected president of the Institute of Export for the seventh year in succession. He has also been elected chairman of the Overseas Standards Advisory Committee of the British Standards Institute.

MR. D. P. CHAPPLE has resigned his positions as managing director and a member of the board of the Anglo Metal Company, Limited, Crosby Square, London, E.C.3. MR. F. C. CHISNELL and MR. C. SUSSMANN have been appointed joint managing directors of the company, and MR. C. E. NISBETT has been appointed to the board as from June 1.

MR. JAMES COWPER, who began his apprenticeship with Henry Balfour & Company, Limited, Durie Foundry, Leven, Fifeshire, in 1899 and continued in the firm's service in various capacities until laid up with a serious illness a year ago, would now have completed 50 years' service but for ill-health. His father also served the company for 49 years.

MR. J. F. B. WRIGHT has retired after 50 years' service with Dorman, Long & Company, Limited, Middlesbrough. Mr. R. Burnell, manager of the company's Ayrton sheet works, in making a presentation to Mr. Wright, said that he was sent some years ago to South Africa in complete charge of the erection of six hand mills and three galvanising lines. These works still stood as a tribute to his skill.

MR. FITZHERBERT WRIGHT has resigned from the board of Aveling-Barford, Limited, road-machinery manufacturers, etc., of Grantham, and has left the company's service. MR. E. E. G. ODDS has been appointed joint managing director of the company, with MR. EDWARD BARFORD, who continues as chairman, and MR. H. C. RYAN has been appointed a director and secretary of the firm and a member of the board of management.

MR. B. E. RICHMOND, previously general manager of the Scottish works of Tecalemit, Limited, has been appointed sales manager of the industrial and marine divisions of the company, in succession to MR. R. R. PARKER, who has taken over the duties of sales manager of the motor manufacture and aviation divisions. The appointments follow the resignation of MR. C. B. BRUDENELL, who is joining Hills Patents, Limited, manufacturers of metal shears, etc., of Francis Street, London, W.C.1, as sales director.

Wills

MONTGOMERY, A. W., proprietor of James Fergus & Company, iron and steel stockholders, of Glasgow	£17,868
DAVIES, CAPT. J. S., late managing director of the Upper Forest & Worcester Steel & Tinplate Works, Limited	£35,729
SMITH, ARTHUR, chairman of Izons & Company, Limited, ironfounders and hollow-ware manufacturers, of West Bromwich	£22,301
WILLIAMS, D. D., formerly joint managing director of Henry Williams, Limited, railway-appliance manufacturers, of Darlington	£135,872
DAVIS, L. S., personal assistant to the managing director of Babcock & Wilcox, Limited, boilermakers, etc., of Renfrew, and a director of Edwin Danks & Company (Oldbury), Limited, engineers, ironfounders, etc., and Penman & Company, Limited, boilermakers, etc., of Glasgow	£6,631

Stocks and Sales of Non-ferrous Scrap

The Ministry of Supply announces that the stock of scrap metals held by the Directorate of Non-ferrous Metals available for disposal at March 31 was 39,747 tons, made up as follows:—Q.F. cases, 1,685 tons; brass ingots, 135 tons; S.A.A. cases, 11,366 tons; copper and copper alloy, 8,490 tons; zinc and zinc alloy, 2,115 tons; lead, 2,468 tons; other grades, 13,488 tons.

Sales for the period February-March amounted to 5,519 tons, the approximate value being £396,500. The analysis was as follows:—S.A.A. cases, 1,270 tons; copper and copper alloy, 2,080 tons; zinc and zinc alloy, 136 tons; lead, 334 tons; other grades, 1,699 tons.

Material put out to tender during the February-March period amounted to 7,405 tons, of which 2,594 tons were lead. During the same period 10,629 tons were invoiced, the value being £737,999.

Changes of Name

The following companies have recently changed their names, the new titles being given in parentheses:—

STABLE STEEL WORKS, LIMITED, Sheffield (John Peace (Steel & Tools), Limited).

HORSELL WELDING COMPANY, LIMITED, London, S.W.1 (Horsell Electrics, Limited).

NOMAG GENERAL ENGINEERS, LIMITED, London, W.1 (Iron Designs & Nomag Engineering, Limited).

News in Brief

WEST BROMWICH CORPORATION has approved plans submitted on behalf of Morris (Engineers), Limited, for extensions to the foundry, mess room and changing room at Bagnall Street, West Bromwich.

DAVY & UNITED ENGINEERING COMPANY, LIMITED, Sheffield, has opened a school for apprentices, and all boys joining the company will spend the first six months of their five-year apprenticeship at the school.

LONG-SERVICE AWARDS have been presented to 294 employees of the Metals Division of Imperial Chemical Industries, Limited. The number included 30 workmen with 40 years' service and over and 19 with 20 years' service.

FLEMING BROS., Glasgow, has secured a contract valued at about £300,000 for the supply and erection of the fabricated steelwork for a new tube factory for Imperial Chemical Industries, Limited, at Kirkby Trading Estate, Liverpool. The steelwork will amount to almost 4,000 tons.

A 14-FT. LONG MODEL of a steelworks, which is to be sent on a tour of the principal cities of the world as a form of advertising to aid the firm's exports, is being made by Samuel Osborn & Company, Limited, Sheffield. The model is being constructed of metal to resist tropical climates.

THE GLASGOW FIRM of John Stobie & Company, iron, metal and scrap merchants, carried on by John North at 75, Haugh Road, until his death, and since then by Gavin M. North and George S. Stirling, executors, has been sold to John Stobie & Company, Limited, 120, Kelvinhaugh Street, Glasgow.

THE STAVELEY COAL & IRON COMPANY, LIMITED, has acquired the whole of the shares in R. D. Nicol & Company, Limited, manufacturers of oils and greases, of Sheffield. Mr. D. M. Anderson will continue to act as managing director of R. D. Nicol & Company, while Mr. M. Haigh will continue as a director and secretary of the company.

MIDLAND BRIGHT DRAWN STEEL & ENGINEERING COMPANY, LIMITED, West Bromwich, South Staffs, has purchased the business of Wilcox & Lines, Limited, manufacturers of hot stampings and pressings in brass and light alloy metals, of Birmingham. The company is equipped with machinery specially laid down for mass production.

AN EXTRA-ORDINARY GENERAL MEETING of East Pool & Agar, Limited, will be held at Winchester House, London, E.C.2, on June 3 at 11 a.m. to consider and, if thought fit, pass with or without modification the resolution: "That the company be wound up voluntarily and that Godfrey Aurelius Anderson, of 20, Copthall Avenue, London, E.C.2, be appointed liquidator for the purposes of such winding-up."

MEMBERS OF the Imperial Defence College made a five-day tour of Sheffield recently. The companies visited included the Hallamshire Steel & File Company, Limited, Joseph Thompson (Sheffield), Limited, manufacturers of milling cutters and reamers, etc., Richard Bros. & Sons, Limited, cutlery manufacturers, etc., and James Dixon & Sons, Limited, one of the city's oldest cutlery and Brittania metal manufacturing firms.

FOR INJURIES RECEIVED in an explosion while cutting up an old German gun in a Sheffield scrap yard, Bertram Arthur Rayner (40), acetylene burner worker, of Rotherham, was awarded £16,809 15s. 6d. (including £809 15s. 6d. agreed loss of wages) at Leeds Assizes on May 3, against the United Steel Companies, Limited, Sheffield, who brought in the Iron & Steel Disposals Company, Limited, Park Lane, London, W.1, as third parties to the action, alleging it was liable.

THE CLAIM for a higher basic wage rate for brass finishers employed by certain firms in the West Riding has been rejected by the National Arbitration Tribunal. The dispute arose out of the men's contention that certain firms in Sheffield, Rotherham and Doncaster should pay the rate applicable in those districts to skilled workers in the engineering industry, which would have meant an increased rate of 2s. 10d. a week in Sheffield and Rotherham and 1s. 11d. a week in Doncaster.

THE DIRECTORS of the British Oxygen Company, Limited, have under consideration a substantial issue of ordinary shares, subject to the approval of the C.I.C. Announcing this at last week's annual meeting, the chairman, Mr. S. J. L. Hardie, also said that the company's capital developments over the next three years to meet the ever-increasing demand for its products at home and oversea were extensive. It is reported that the company is seeking a site at Tinsley Park, Sheffield, to establish a large oxygen plant.

TUBE INVESTMENTS, LIMITED, has acquired the premises and plant of the British Ideal Patents & Furniture Company, Limited, Enfield, Middx, which has been merged with the subsidiary, Pel, Limited, manufacturers of tubular furniture, of Oldbury, Birmingham. The shop-fitttings and display-stand business, formerly conducted by the British Ideal Patents Company, will be continued by Pel, Limited, at the Enfield works, which, it is intended, will also provide additional manufacturing capacity to meet the growing demand for Pel furniture.

MR. W. C. PEGLEY, managing director of Vactric, Limited, engineers, of Stanmore, Middx, stated recently that the negotiations for the sale of his shares in the company have been satisfactorily concluded. The administrative steps preliminary to the repayment of the Treasury loan have been initiated by the purchasers. Mr. Pegley has declined to reveal the names of any of the interests or persons concerned with the purchase. The company's plans are to be fully explained in a statement to be issued shortly to shareholders prior to an extra-ordinary meeting.

RESOLUTIONS approving the scheme of arrangement of Richard Crittall & Company, Limited, Brentford, Middx, were passed at meetings of shareholders and creditors recently. The effect of the scheme is that unsecured creditors of the parent company receive 4s. 6d. in the £, preference shareholders 1¼ ordinary shares of 1s. for each preference and the ordinary shareholders one 1s. ordinary for four held. Mr. H. Victor Cozens, the chairman, emphasised that, without compromise between unsecured creditors and the two classes of shareholder, liquidation was inevitable with complete loss both for creditors and shareholders.

Company News

(Figures for previous year in brackets.)

HEATRAE—Dividend of 12½% (same).
TECALEMIT—Interim dividend of 6% (same).
HUDSON & WRIGHT—Dividend of 40% (same).
VAB PRODUCTS—Interim dividend of 5% (same).
R. B. PULLIN & COMPANY—Dividend of 10% (same).
JOHN RIGBY & SONS—Interim dividend of 5% (same).
PLESSEY COMPANY—Interim dividend of 10% (same).
TUBE INVESTMENTS—Interim dividend of 12½% (same).
TEXTILE MACHINERY MAKERS—Dividend of 6% (same).
RICHARD HILL & COMPANY—Interim dividend of 10% (same).
BANKS & DAVIS—Final dividend of 25%, making 100% (same).
W. G. FRITH & COMPANY—Final dividend of 5%, making 10% (same).
EVER READY (IRELAND)—Dividend of 12½% on larger capital (12½%).
W. TYZACK, SONS & TURNER—Interim dividend of 5%, tax free (same).
C. A. PARSONS & COMPANY—Final dividend of 7½%, making 12½% (same).
BRISTOL AEROPLANE COMPANY—Final dividend of 6%, making 10% (same).
S. SMITH & SONS (ENGLAND)—Interim dividend on the preferred shares of 7% (same).
STEEL PARTS—Interim dividend of 15%. The company was made public in December, 1948.
COWLISHAW, WALKER & COMPANY (made public last November)—Dividend of 10%, less tax (nil) and bonus of 5% tax free (nil).
RANSOMES & RAPIER—Final ordinary dividend of 5%, making 7½ (same), and of 2½% on the new ordinary shares, making 3¾%, all free of tax.
NEWMAN INDUSTRIES—Final dividend of 10% (15%), making 17½% for the period January 4, 1948, to January 1, 1949 (20% and bonus of 2½%).
SHEFFIELD TWIST DRILL & ENGINEERING COMPANY—Final dividend of 20⅝%, making 33¾% (8⅜% for three months, equivalent to 33¾% per annum).
MORRIS MOTORS—Net earnings for the year to December 31, 1948, £1,513,555 (£2,622,636); final dividend of 14½%, making 24½%, tax free (same); forward, £264,741 (£262,579).
PERFECTA MOTOR EQUIPMENTS—Trading profit for 1948, £28,848; profit on sale of cars, £1,345; to directors' emoluments, £7,647; depreciation, £4,210; taxation, £8,400; net profit, £9,636 (£9,400); dividend of 17½% (same); general reserve, £2,500 (same); future taxation, nil (£1,000); forward, £14,600 (£13,245).
BRITISH OPTICAL & PRECISION ENGINEERS—Profits for nine months to December 31, 1948, subject to tax and interest payable on secured notes and bank overdraft, £203,697; interest payable on secured notes 9½ months, £67,292; bank and other interest, £6,193; taxation, £55,992; dividend of 5%; forward, £36,841.
METROPOLITAN ELECTRIC CABLE & CONSTRUCTION COMPANY—Net profit for 1948, before tax, £92,269 (£121,124); brought in (after transferring £50,000 (nil) during the year to assets replacement reserve), £64,985 (£65,311); to provision for tax, £50,400 (£66,500); general reserve, £8,000 (nil); final dividend of 5% (nil), making 15% (same); forward, £93,904.
DRAKES—Trading profit for 1948, £57,108; dividends, £213; to bank interest and commission, £3,780; depreciation, £4,484; taxation, £20,596; net profit, £28,261; preference dividend, £1,320 net; ordinary dividend of 10% (same, plus centenary bonus of 10%); general reserve, £20,000; maintenance of buildings, £5,000; forward, £25,649 (£25,633 after additional directors' fees of £200).
MANCHESTER TINNING COMPANY (made public February, 1948)—Profit and loss account for the period February 16, 1948, to February 28, 1949, shows gross profit, £25,234; to depreciation, £3,381; managing directors' salaries, £4,167; directors' fees, £550; audit fee, £157; registrars' fees, £357 estimated taxation, £10,387; net profit, £6,235; final dividend of 5%, making 15%; forward, £1,285.
JOSHUA BIGWOOD & SON—Group profit for 15 months to December 31, 1948, £63,359; E.P.T. refund, £12,934; to depreciation, £14,293; auditors' remuneration, etc., £791; directors' remuneration, etc., £14,131; leaving £47,078; parent company's profit, £52,538; to income tax, £8,025; profits tax, £8,000; preference dividend, £3,564; final ordinary dividend of 3⅜%, making 18⅜%, £12,065; general reserve, £21,000; forward, £29,324 (£29,440).
ROLLS RAZOR—Net trading profit of group for 1948 (after deducting £15,124, provision in respect of unrealised intercompany profit on stocks held by a subsidiary), £162,259; to depreciation, £14,526; directors' emoluments, £15,048; auditors' remuneration, £1,315; U.K. tax, £72,581; net profit, Rolls Razor, after tax, £65,462 (£60,864); to general reserve, £25,000 (£30,000); preferred ordinary dividends, £8,250 (same); deferred dividend of 100% (same), £27,500; forward, £6,962 (£2,150).
WALLSEND SLIPWAY & ENGINEERING COMPANY—Trading profit for 1948, £340,230 (£297,840); provisions not required, nil (£33,587); other income, £23,625 (£22,029); to taxation, £154,940 (£141,293); depreciation, £31,151 (£31,110); directors' emoluments, £10,123 (£13,128); net profit, £167,541 (£167,925); to reserve for renewals and reconstruction, £100,000 (nil); staff superannuation, £10,000 (£20,000); general reserve, nil (£85,000); final dividend of 13% and bonus of 10%, making 30% (same); forward, £53,856 (£48,992).
INTERNATIONAL TWIST DRILL COMPANY—Consolidated revenue in 1948, £111,885 (£106,294); to depreciation, £19,003 (£13,918); ground rents and interest, £193 (£500); directors' emoluments, £14,890 (£8,623 excluding salaries); tax, £14,641 (£20,438); net profit, £63,158 (£62,815); brought in, £43,593 (£39,613); non-recurring income, nil (£5,796); profit, less estimated tax of £21,843 (£25,114) for 1949-50, £41,315 (£37,701); available, £84,908 (£83,110); to general reserve, £5,000 (£10,000); dividend of 100% (125%); forward, £52,408.
C. & W. WALKER—Consolidated trading profit, with investment income and unrequired provisions of £5,304 for the year ended January 31, £76,608 (£67,834); to directors' emoluments, £6,244 (£6,457); depreciation, £7,324 (£7,207); deferred repairs, nil (£4,329); tax, £31,170 (£31,178); balance attributable to parent company, £28,587 (£16,922); to minority shareholders, £3,283 (£1,671); brought in by parent company, £23,019 (£22,205); available, £51,606 (£39,197); to contingency reserve, £10,000 (£5,000); general reserve, £5,125 (£1,625); dividend of 10% and bonus of 5% (same); forward, £26,328.
FEDERATED FOUNDRIES—Total income in 1948, £486,428 (£282,057); to depreciation, £100,739 (£63,921); tax, £243,977 (£156,441); net profit, £141,712 (£61,695); to written off goodwill in subsidiaries, £36,765 (nil); general reserve in subsidiaries, £39,000 (£20,000); leaving £65,947 (£41,695); readjusted balances brought in, £54,631 (£46,292); available, £120,578 (£87,987); dividend of 10% (5%); forward, £62,450. A sum of £43,504 over-provided for tax has been utilised as to £16,000 transferred to general reserve in subsidiaries; £8,819 written off patterns in subsidiaries and £18,685 written off goodwill in subsidiaries.
COLVILLES—Consolidated accounts for 1948 show group trading profit, £3,598,237 (£3,273,393); other income, £39,638 (£29,161); to deferred repairs, nil (£112,641); depreciation, £415,549 (£424,095); income tax, £1,435,553 (£1,262,591); profits tax, £479,846 (£440,253); net profit, £1,306,927 (£1,062,974); provisions restored, taxation 1939-45 £384,385 (£150,000), other provisions £273,366 (£19,022); income relating to previous years, net, £12,906 (£65,455); to replacement reserves, £742,220 (£185,000); general reserves, £550,000 (£484,022); dividends; preference, £73,013 (same), ordinary of 13% £280,249 (same); forward, £1,574,864 (£1,242,763).
GUEST KEEN BALDWINS IRON & STEEL COMPANY—Consolidated trading profit for 1948, £1,543,807; investments income, £249,640; miscellaneous income, £9,170; to 4% first mortgage debenture interest, £79,016; depreciation, £255,000; auditors' remuneration, £2,193; profits tax, £193,650; income tax, £644,932; profit retained by a subsidiary, £123; parent company's profit, £627,703 (£372,864); to interest on 5% income notes, £12,678; general reserve for redemption of debentures, £33,366; capital reserve for redemption of income notes, £13,309; preference dividends, £42,968; ordinary dividend of 10%, £202,125; forward, £614,614 (£291,347).
SUPERHEATER COMPANY—Consolidated trading balance, plus sundry revenue in 1948, £346,101 (£252,569); to depreciation, £26,335 (£15,111); auditors' remuneration, £641 (£617); tax, £173,390 (£137,559); profit, £145,745 (£99,282); brought in, £37,941 (£33,426); available, £183,686 (£142,679 with £971 investment profits and £9,000 unrequired tax provision); to pre-

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ference redemption, £6,656 (£6,347); preference dividend, £4,051 (£4,178); general reserve, £75,000 (£46,000); research, £5,000 (nil); pensions, £2,500 (same); written off investments, £2,539 (£5,169); 5½% preference dividend, £7,889 (£8,059); final ordinary dividend of 25%, making 45% (same); forward, £35,956.

TELEGRAPH CONDENSER COMPANY—Profit on trading for 1948, £202,954 (£310,199); interest on loan investment and tax reserve certificates, £1,528 (£853); to depreciation, £18,185 (£17,783); directors' fees, £2,300 (same); management remuneration, £8,926 (£8,752); audit fee, £551 (same); deferred repairs, dilapidation, rehabilitation and removals, etc., nil (£26,096); tenants' expenditure on leasehold factory, nil (£20,052); research scheme, nil (£20,000); profits tax, £22,500 (£43,000); income tax, £72,597 (£110,000); final dividend of 10%, making 15% (same); supplementary pension, nil (£25,000); general reserve, £60,000 (£20,000); forward, £43,843 (£41,085).

LANCASHIRE STEEL CORPORATION—Consolidated earnings for 1948, £1,892,573 (£1,456,584); income from investments, £68,223 (£131,065); to depreciation of fixed assets, £349,013 (£319,124); taxation, £900,000 (£702,750); taxation (initial allowances) equalisation reserve, £150,000 (nil); reserve for increased cost of plant and buildings, nil (£100,000); staff superannuation, £15,606 (£30,606); balances available to Lancashire Steel Corporation, £518,715 (£425,962); retained in subsidiary companies, £27,462 (£9,307); balance available to Lancashire Steel Corporation with £201,247 (£140,277) brought in totals £719,962 (£566,239); to general reserve, £300,000 (£150,000); "A" and "B" ordinary dividend of 8% (same); forward, £304,970 (£201,247).

EVER READY COMPANY (GREAT BRITAIN)—Trading profit for the year ended February 28, £632,406; income from investments in subsidiaries, £6,560; from trade investments, £36,847; profits on sale of various subsidiaries and other small investments, £31,431; to directors' remuneration, £87,845; written off buildings, plant, etc., £80,000; auditors' remuneration, £1,480; net profit, £537,919 (£531,370 for previous 11 months); dividend of 40% (same); reserve, £100,000 (£90,000); staff benevolent fund, £14,000 (same); forward, £118,414 (£118,656). It is computed that the provisions for taxation will be more than sufficient to cover the estimated liability to profits tax and income tax on the profits of the year and no charge for these taxes has been made in the accounts.

BELL'S ASBESTOS & ENGINEERING (made public October, 1948)—Consolidated accounts for 1948 show trading profit, £210,639 (£176,506); reserve against shares in subsidiaries not required, £3,584 (nil); dividends, £3 (£1); to depreciation, £11,933 (£6,720); audit, £1,618 (£1,434); written off preliminary expenses, £14 (£133); employees' bonus, £15,526 (£13,758); tax, £95,696 (£90,168); net profit, £89,439 (£64,293); to subsidiary general reserve, £5,000 (nil); minority interests, £2,665 (£1,256); carried forward by subsidiaries, £30,023 (£13,049); available for parent company, £51,751 (£49,988); brought in, £74,509 (£30,351); transfer from general reserve, £25,000; less capitalisation of profits for bonus share issue, £84,800; to dividends, including 35% on the ordinary shares, £31,629 (£5,830); forward, £34,931.

BRITISH ROPES—Consolidated trading profit in 1948, £1,323,480 (£1,082,106); sundry revenue, £107,000 (£87,519); to auditors' remuneration and expenses, £5,837 (£6,170); depreciation, £241,822 (£179,088); tax, £626,865 (£516,943); outside shareholders, £32,371 (£30,590); retained by subsidiaries, £108,041 (£80,346); net profit of holding company, £415,812 (£356,488); brought in, £380,272 (£299,035); available, £796,084 (£655,523); to preference dividend, £20,746 (same); preferred ordinary dividend, £24,204 (same); final ordinary dividend of 15%, making 20% (same); pensions, nil (£30,000); general reserve, £200,000 (£75,000); forward, £425,833. Provision for stock contingencies has been increased by £125,850, representing a surplus from a variation in the basis of stock valuation applied as at January 1, 1948.

HOFFMANN MANUFACTURING COMPANY—Consolidated profit on trading for 1948, £877,680 (£591,357); dividends, etc., £26,610 (£16,103); to depreciation, £123,264 (£112,387); directors' fees, £3,563 (£4,345); pensions, £31,510 (£25,441); trustees' fees, £158 (same); audit, £1,695 (£1,328); expenses, £311 (£347); income tax for 1949-50, £298,430 (£141,051); profits tax for 1948, £87,500 (£65,000); group's net profit, £357,858 (£257,403); retained by subsidiaries, £32,081 (£14,842); net profit, Hoffmann Manufacturing Company, £325,777 (£242,561); debenture interest (net), £5,633 (£5,870); 7½% preference dividend (net), £20,625 (same); ordinary dividend of 7½%, free of tax (same); to benevolent fund, £10,000 (nil); stock reserve, £50,000 (nil); fixed asset replacement, £175,000 (nil); special depreciation and obsolescence, nil (£120,000); general reserve, nil (£33,615); forward, £172,359 (£145,340).

POWER SECURITIES CORPORATION—Consolidated profit in 1948, £366,266 (£267,178); investment income, £12,637 (£34,205); to directors' emoluments, £16,268 (£18,140); bank loan interest, £5,344 (nil); auditors' remuneration, £262 (£126); trade investment written off, £6,204 (£5,600); depreciation, £63,111 (£56,987); tax, £155,385 (£113,999); subsidiary minority interests, £3,652 (£9,018); consolidated net profit, £128,677 (£97,513), with £50,628 (£62,124) dealt with in accounts of holding company and £68,049 (£35,389); retained by subsidiaries; brought in, £106,747 (£105,534); over-provided tax, £56,933 (nil); consolidated balance available, £292,357 (£203,047); to pensions, £5,550 (same); writen off goodwill, £2,214 (nil); general reserve, £56,370 (£20,000); contracts' reserve £50,000 (£25,000); dividend of 6% (same); forward, £132,473, divided as to £64,527 (£54,003) by holding company and £67,946 (£52,744) by subsidiaries.

ASSOCIATED ELECTRICAL INDUSTRIES—Consolidated accounts for 1948 show aggregate trading profit, £6,219,892 (£4,452,984); dividends, £140,060 (£159,817); miscellaneous profits, £72,926 (£27,138); making, £6,432,878 (£4,639,939); to depreciation, £832,580 (£758,514); audit, £8,432 (£8,320); additions to provisions, £179,894 (£214,403); tax, £2,886,079 (£2,096,916); consolidated net profit, £2,525,893 (£1,561,696); to minority holders in subsidiaries, £4,245 (£11,619); balance attributable to A.E.I., £2,521,648 (£2,550,077); carried forward or added to reserves by subsidiaries, £564,727 (£287,820); available for appropriation by A.E.I., £1,956,921 (£1,262,257); brought in by A.E.I., £411,792 (£344,400); transfer from fuel crisis reserve, nil (£65,305), making £2,368,713 (£1,671,962); to general reserve, £1,024,438 (£547,475); other reserves, £314,048 (£100,249); dividend of 15% (same); forward, £417,781.

CHLORIDE ELECTRICAL STORAGE COMPANY—Consolidated accounts for 1948 show profit, £1,807,644; investment income, £103,789; profit relating to previous years, £130,483; to depreciation, £217,193; reserve against possible fall in value of stock, £477,500; directors' emoluments, £42,720; auditors' remuneration, £6,467; leaving £1,298,036 (£1,534,153—this and other 1947 figures have been adjusted to make them comparable with 1948 figures, with the exception of the figures of the parent company, which in 1947 covered nine months); to taxation, £980,697 (£1,179,571); balance available, £317,339 (£354,582); profit retained by subsidiaries, £52,184 (£99,511); parent company's profit, £265,155 (£255,071); to general reserve, £100,000 (same); pensions scheme, £25,000 (same); preference dividends, £2,046 (£1,535); final dividend on the "A" and "B" ordinary shares of 5% and bonus of 10%, making 20% (same); forward, £240,978 (£222,626), plus subsidiary companies' carry-forward £105,448 (£122,675), making £346,426 (£345,301).

ALBRIGHT & WILSON—Consolidated profit and loss account for 1948 shows trading profit, £1,324,990; dividends and interest, £24,977; to depreciation—Albright & Wilson £81,617, subsidiaries £125,425; obsolescence and replacement, £80,000; to directors—fees £850, management and superannuation £43,883; pensions, £4,500; audit, £1,609; profit, £1,012,083; the net profit is apportionable as follows:—To 1947 £47,016, to Albright & Wilson £881,006, outside holders of subsidiaries £84,061; to U.K. profits tax, £113,112; income tax, £260,195; overseas, £137,700; net profit, £501,076; to outside holders of subsidiaries, £55,662; to Albright & Wilson, £445,414; brought in, £958,688; taxation and other provisions no longer required, £230,058; available, £1,634,160; to capital increase expenses, £61,428; to general reserve—Albright & Wilson £273,988, subsidiaries £256,396; preference dividend, £2,112; ordinary final dividend of 15%, making 25%; balance forward—Albright & Wilson £145,891, subsidiaries £755,253. The company was made public in March, 1948.

BABCOCK & WILCOX—Consolidated trading profit for 1948, £2,167,544 (£1,505,760); dividends on investments, £61,101 (£51,606); interest on investments, £29,904 (£48,839); war losses—amount recovered, £348 (£1,839); to depreciation of properties, £129,852 (£64,496); off plant, machinery, etc., £262,419 (£245,199); off patents and trading rights, £16,870 (£15,141); to pensions, £97,312 (£89,314); deferred repairs, £2,000 (£36,435); net profit, £1,750,444 (£1,157,459); to profits tax, £266,104 (£195,439); income tax, £624,646 (£417,254); net profit attributable to Babcock & Wilcox, £858,771 (£543,147), to minority members of subsidiaries £923 (£1,619); to the Babcock & Wilcox balance has been added £34,796 (nil) sundry

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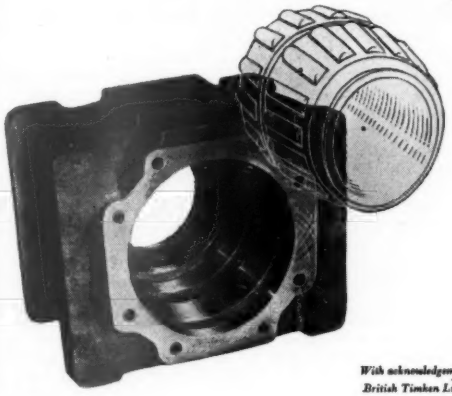

With acknowledgements to British Timken Limited

A carbon steel **is used, conforming to B.S.S. 592/194 Grade II; physical properties are as follows:—**

Yield Point	— Tons Square Inch	—	20/25
Ult. Stress	— " " "	—	35/39
Elongation Per Cent		—	20/24
B.H.N.		—	150/180
Bend		—	90°/120°

Each casting is carefully tested to ensure that it is mechanically sound, and finally pressure tested while submerged in water before leaving the Steel Foundry. So little affected was a body that was taken down after 1,000,000 miles, that after minor attention it was returned to service.

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BSFA
STEEL CASTINGS

capital credits; the interim dividends paid November 12 absorbed £122,406 (£122,368), and the proposed final dividends and bonus take £240,648 (£240,644); to statutory reserves, £329 (£258); to general reserves, £512,001 (£170,625); to increase of capital of foreign subsidiary, £5,216 (nil); unappropriated Babcock & Wilcox £164,238 (£161,909), subsidiaries £35,029 (£24,394).

IMPERIAL CHEMICAL INDUSTRIES—Group's trading profit for 1948 (including approximately £450,000 (£440,000) relating to previous years), £29,375,063 (£22,913,165); revenue from subsidiaries not consolidated, nil (£298,875); from associated companies (including £648,756 in the form of scrip dividends from overseas companies), £1,373,299 (£1,277,657); from marketable investments, £216,582 (£337,597); revenue from property, £261,872 (£238,164); interest and miscellaneous income, £82,106 (£142,388); to debenture and loan interest, £329,010 (£278,678); auditors' remuneration, £47,021 (£45,143); pension funds, etc., £2,472,019 (£2,886,185); miscellaneous expenditure, written off, £155,343 (£449,195); obsolescence and depreciation, £5,349,950 (£4,340,420); U.K. and overseas tax (less £197,788 (£425,891) overprovisions in previous years), £11,058,523 (£8,917,366); net consolidated income, £11,897,056 (£8,290,869), of which £401,872 (£352,849) is attributable to minority members of subsidiaries, £644,770 (£291,077) is undistributed income of subsidiaries and £10,850,414 (£7,646,933) net profit of parent company; to central obsolescence and depreciation provision (additional), £3,000,000 (same); capital reserve, £1,000,000 (nil); revenue reserve, £1,000,000 (same); 7% preference dividend for the year, £962,992 (same); interim ordinary dividend of 3% (same), £832,674 (same); final ordinary dividend of 7% (same), £2,331,488 (£1,942,907); forward, £4,009,436 (£3,250,175). The final ordinary capital is payable on £10,093,023 additional capital issued in August, 1948.

GUEST, KEEN & NETTLEFOLDS—Net profit of the group for the period to December 31, 1948, £2,918,582 (£1,793,216 for 12 months to March 31, 1948); the directors point out that although the holding company's accounts cover a period of nine months only, those of most of the subsidiaries cover 12 months and therefore the greater part of the profits brought into consideration for this abnormal period relate to a full year; the profit and loss account has been credited, in addition, with the profit on the realisation of investments, £80,255 (£238,281), surplus taxation of previous years £336,281 (£113,136), and sundry income less charges not applicable to the period £60,681 (£98,856); after allowing for proportion of profits of subsidiaries attributable to shares held outside the group, £72,015 (£40,248), and profits retained in the accounts of subsidiaries of £1,388,814 (£278,968), the amount brought into the accounts of the holding company is £1,935,070 (£1,924,273); the board has transferred to the general revenue reserve of Guest, Keen & Nettlefolds £1,000,000 (£745,942); final dividend of 6%, making 10% for the period (11% for the year); the directors state that in recommending this distribution on the ordinary stock in these unusual and non-recurring circumstances, they place on record that they are not establishing any criterion as to the annual rate of ordinary dividends in the future; to dividends on the first, second and third preference stocks and the interim and final dividends on the ordinary shares, £750,806 (£873,984); forward, £1,801,530 (£1,617,266).

Iron and Steel Workers Seek Arbitration

Union leaders of 20,000 maintenance men in the iron and steel industry decided at Manchester last week to seek arbitration on their rejected claim for a new national wage agreement giving a consolidated rate of £6 15s. weekly, plus a minimum tonnage bonus of 10s. The application seeks to abolish present district rates.

Mr. George Cole, secretary of the Joint Committee representing the nine craft unions involved, said that the next step would be an approach to the Iron and Steel Trade Employers' Association for agreed terms of reference for dealing with the case under the Industrial Court Act, 1919. In the event of failure to agree on terms the dispute would be referred to the Ministry of Labour.

Steel Industry's Achievement

April Output Record Despite Holidays

Although the Easter holidays fell during the month, steel production in April established a new record for that month. Output was at an annual rate of 15,854,000 tons, which compares with 15,283,000 tons in April of last year, which was the previous highest April output. Production in April, 1948, was not interrupted by holidays, so that last month's returns were particularly noteworthy.

Pig-iron output last month was affected by the number of furnaces being relined. Production was at an annual rate of 9,288,000 tons, against 9,433,000 tons a year ago.

Latest steel and pig-iron output figures (in tons) compare as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1949—January ..	178,100	9,262,000	288,500	15,002,000
February ..	181,200	9,422,000	311,100	16,176,000
March ..	178,800	9,295,000	312,900	16,269,000
April	178,600	9,288,000	304,900	15,854,000
1948—January ..	167,800	8,726,000	280,600	14,589,000
February ..	176,300	9,169,000	289,400	15,049,000
March ..	178,900	9,303,000	290,700	15,117,000
April	181,400	9,433,000	293,900	15,283,000

Empire Mining and Metallurgical Congress

Sixteen countries of the British Commonwealth and 11 other countries are to be represented at the fourth Empire Mining and Metallurgical Congress to be held in Great Britain from July 9 to 23 next. About 600 delegates and members will attend the Congress in London and 300 will take part in the technical sessions in Oxford and visit the various excursion centres. The Congress, which is convened by the Empire Council of Mining and Metallurgical Institutions, was first held at the Empire Exhibition, Wembley, in 1924. The second Congress was in Canada in 1927 and the third in South Africa in 1930. Economic conditions led to the abandonment of the projected fourth Congress in Australia in 1933 and it was not then possible to organise it until after the war.

The chief object of the Congress is to enable scientists, engineers and others concerned in the mining and metallurgical industries to discuss technical progress and problems, including the development of the mineral resources of the Commonwealth. The honorary president is the Prime Minister, and the president is Sir Henry Tizard, chairman of the British Government's Advisory Council on Scientific Policy.

THE OPENING of the Sheffield district office of the British Thomson-Houston Company, Limited, 50 years ago, was celebrated recently by a dinner and dance.

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Raw Material Markets

Iron and Steel

The output of castings from the foundries, both light and heavy, is maintained at a satisfactory level. There has been a marked improvement in delivery dates in recent months, although some of the foundries, particularly the light foundries, are still hampered by shortage of pig-iron. Production of high-phosphorus pig-iron is maintained at a high level, but the number of furnaces in blast is insufficient to meet all requirements. In fact, many foundries' stocks are exhausted and they are thus dependent on current deliveries. Supplies will no doubt improve when the units now under construction or being relined are put into blast.

The engineering, speciality and jobbing foundries continue to make heavy demands for low- and medium-phosphorus pig-iron and hematite, and supplies are not in excess of requirements. Consumers would welcome larger tonnages of low-phosphorus iron. Hematite is also difficult. Supplies of this grade are usually in the lower silicon types, which is a further handicap to the foundries. The refined grade is being used to eke out supplies, and foundries are specifying this grade in increasing quantities. There is a keen demand for cast-iron and steel scrap, but stocks are on the low side.

Owing to the stringency in supplies of all grades of foundry pig-iron and hematite, none is available for export, although small parcels of the refined grade are being sent abroad. It would help exporters of castings if they were permitted to quote firm prices, as overseas suppliers are able to do.

Foundry coke supplies are coming forward satisfactorily against the allocations for the summer period.

Non-ferrous Metals

Announcing reductions in its bulk-selling prices for copper, lead and zinc, effective as from Monday last, the Ministry of Supply states that they have been made "in the light of recent falls in American market prices, and representations from various interests as to the effect on U.K. trade and exports." The prices are still well above world levels. New maximum prices, per ton, are:—Electrolytic copper, £130 (a fall of £10); good soft pig-lead, £95 (a fall of £11), and good ordinary brand zinc, £85 (a fall of £16). The Ministry's statement continues:—"Having regard also to the present uncertainties in world markets, and to forward commitments into which the Ministry has entered in order to safeguard sterling supplies, the Minister has decided, with effect from to-day (May 16), to reduce selling prices for copper, lead and zinc." Discounts and premiums remain unchanged, but a further £10 decline in the Ministry's buying price for rough copper in slabs of from 2 to 3 cwt. to £80 per ton has been announced. This price was lowered on April 27 by £15 to £90 per ton.

Complaints have recently been made by many sections of British industry that they are compelled to buy non-ferrous metals from the Ministry of Supply at prices much above those ruling in world markets. Even allowing for delivery charges, the new levels are about £25 per ton more for copper, and £12 per ton each for lead and zinc above American prices.

The weakness of metal prices in the United States has continued, and last week saw copper down by a further ½ cent. to 18 cents, while lead, in spite of the show of moderate firmness at 15 cents, gave way by a further 1 cent to 14 cents. There has been talk of buying power building up, as consumers of lead, zinc and copper persist in staying out of the market. This is, of course, undoubtedly true to some extent, but it should not be overlooked that the producers also are piling up tonnage not being currently sold. The likelihood is that values will move to still lower levels before consumers are persuaded that the time has come to cast caution aside and help themselves at the relatively low levels that have been reached. But this spasm, when it comes, is likely to be short and sharp, for confidence has been much undermined and we doubt whether the users will follow a price recovery very far. To endeavour to estimate the turning points of the metals is probably futile, for just as in a rising market, the top always lies ahead, so when prices react downwards there is an inclination to take too bearish a view of things. However, in metal circles there is talk of 16 cents for copper and 12 cents for lead. As for zinc, in many ways the most vulnerable of them all, a figure as low as 10 cents has been mentioned. These prognostications must, of course, be taken with reserve, for nobody really knows when the bottom will be reached.

Newton Chambers & Company

Benefit from Foundry Mechanisation

"The mechanisation of our heavy-castings foundry continues and we are already feeling the benefit of this important development," said Sir Samuel Roberts, Bt., chairman of Newton Chambers & Company, Limited, at the recent annual meeting of the company at Thorncliffe. The company had a very full order-book in that department and the demands of the gas and chemicals as well as the iron and steel industries were urgent and insistent, he said. The mechanisation of the light-castings department was completed last year and this unit was now operating most efficiently. The curtailment of the Government's housing programme affected the department by reducing immediate demand for castings for the building trade, but the foundry was ready to deal with any revival of this business and, in the meantime, was being fully employed on other types of iron work.

THE MINISTRY OF FOOD has announced that during the four-week period ending June 4 its official selling price of linseed oil has been reduced from £170 to £150 per ton, naked, ex-works, while the price of castor oil crude firsts has also been reduced from £142 to £122 per ton.